One-third of the Nation's Plants have Substandard Boilerhouses

J.E. TOBEY, PRESIDENT

APPALACHIAN COALS, INCORPORATED

See Page 13

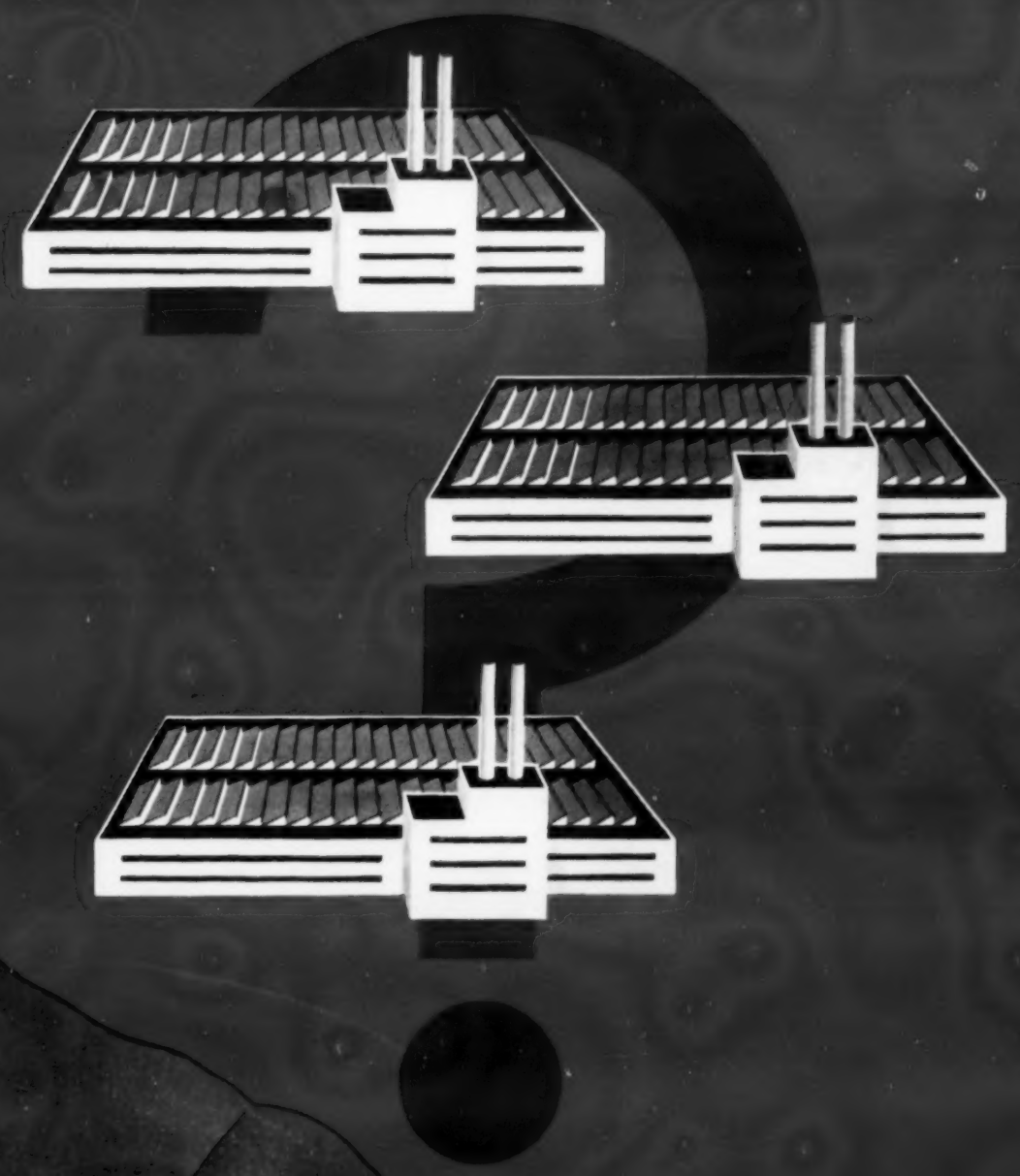
Industry Power

A Putman Publication | "Executive Magazines for Industry"

MAY 1957

For Men Who Manage

Power Services



$1.00 the copy

The 16,000 users of YARWAY Blow-Off Valves include utilities, industrial plants, institutions and government installations—well-known plants and plants you've never heard of; large plants, small plants; with boilers of every pressure rating.

But there's one thing these companies have in common—*dependable blow-down service*. Their YARWAY Blow-Off Valves give them advanced engineering design, improved metallurgy, careful workmanship, exacting test standards and experienced field service.

On blow-off valves, *go* YARWAY—*with confidence*.

UTILITIES

Boston Edison Co.
Consolidated Edison Co.
Jersey Central Power & Light Co.
Penna. Power & Light Co.
Philadelphia Electric Co.
Dow Chemical Co.
Chesapeake & Ohio Railroad Co.
Aluminum Co. of America
American Tobacco Co.
Celanese Corporation of America
Cities Service Oil Co.
Container Corp. of America
New York State Schools
Philadelphia Public Schools
U. S. Veterans' Hospitals
Kentucky State Hospital
Oklahoma A & M College
Texas A & M College
University of North Carolina
Carnegie Institute of Technology
Indiana State Reformatory
Massillon (Ohio) State Hospital
Purdue University
University of Chicago
Mare Island Naval Shipyard
Puget Sound Naval Shipyard
U. S. Prison (Alcatraz)
Western Reg'l Lab. Dept. of Agriculture

YARWAY BLOW-OFF VALVES ARE KNOWN BY THE COMPANIES THEY KEEP

Arizona Public Service Co.
Florida Power Co.
Public Service Co. of Oklahoma
Texas Power & Light Co.
Metropolitan Edison Co.
Central Illinois Public Service Co.
Cleveland Electric Illuminating Co.
Iowa Electric Light & Power Co.
Nebraska Power Co.
Tennessee Valley Authority
Calif. Elec. Power Corp.
Colorado Public Service Co.
Pacific Power & Light Co.
Southern Calif. Edison Co.
Washington Water Power Co.

INDUSTRIALS

Atlantic Refining Co.
Bethlehem Steel Co.
E. I. du Pont de Nemours & Co.
Eastman Kodak Co.
R. J. Reynolds Tobacco Co.
Goodyear Tire & Rubber Co.
Hercules Powder Co.
Armour & Company
International Harvester Co.
Monsanto Chemical Co.
Procter & Gamble Co.
U. S. Steel Co.
United Air Lines
Westinghouse Electric Co.
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100 Mermaid Avenue,
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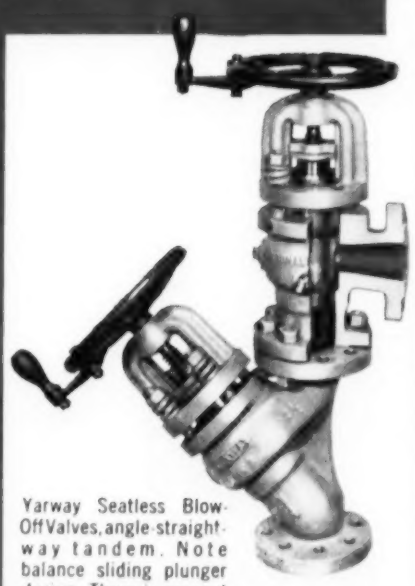
BRANCH OFFICES IN PRINCIPAL CITIES



Yarway Seatless Blow-Off Valves, angle-straightway tandem. Note balance sliding plunger design. There is no seat to score, wear, clog or leak. Write for Bulletin B-426.

YARWAY STEAM PLANT EQUIPMENT

Circle 144 on READ-N-CIRCLE card for more data

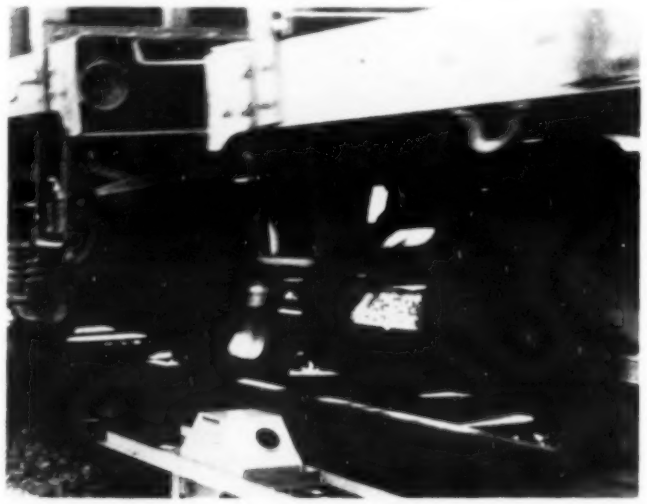
that's interesting

. . . for industry power

"Hot-box detective" on the job

Chesapeake and Ohio Railway is using an infra-red "Hot-Box Detective" to sleuth out overheated journal boxes.

Electronic detectors, developed by the Servo Corporation, are located outside and parallel to rails. Detector



head contains an infra-red pyrometer with lens, angled at 45 degrees, aimed at bottom and side of passing journal. Equipment tape records temperature of every passing journal box regardless of train's speed. When detector finds a journal box above a certain temperature, it flashes a warning to signal mechanism, and train is stopped.

Industry wouldn't hire Edison, Wright Brothers?

"If Thomas A. Edison and the Wright brothers were 20 years old today, they would have great difficulty in finding technical positions worthy of their talents in American industry." So charged Carl G. Sontheimer, executive vice president of CGS Laboratories, Inc., Stamford, Conn., before the recent IRE convention in New York City.

American industry is concentrating so much effort on getting college-trained engineers, regardless of their creative abilities, that much of the country's inventive talent is being wasted, said Sontheimer. "We seem to have forgotten that many of the basic technical inventions — the electric light, the phonograph, and the airplane — were made by men without an engineering degree."

Measures underground cavities

Sonar Caliper, new electric-line tool to measure shape and size of underground cavities has been recently developed by Dowell, Inc., a subsidiary of Dow Chemical Corporation. New tool has been adapted from devices used in sonic navigation and ranging.

Caliper works on pulse-echo idea, timing rate of sound travel through a fluid medium. Sound waves produced by the subsurface tool are picked up by a receiver after they have traveled to the cavity wall and back. Tim-

ing device records the interval, which is converted into distance. Cavity circumference is shown on a Polaroid-photo recording unit.

Narrow-band TV now practicable

Transmission of narrow-band television pictures over ordinary telephone cable pairs is now feasible. Experimental results were given in a paper before the Franklin Institute of Philadelphia recently by C. Raymond Kraus, General Staff Transmission Engineer of Bell Telephone Company of Pennsylvania.

New system, developed by Pennsylvania Bell with General Precision Laboratory and Dage Television Division of Thompson Products, utilizes standard telephone cable facilities for transmission. Operates successfully up to distances of 10 to 15 miles. Frequency bandwidth used is 250,000 cps, compared with 4,000,000-cps bandwidth of ordinary television.

Thus, a readymade network of cable facilities is available for picture transmission. There are only 15,000 video conductor miles in the Bell system, compared with nearly 235 million miles of ordinary cable conductors.

Design own railroad cars

Huge sizes of transformers and condensers now a-building have caused manufacturers to design their own railroad cars for shipping. Two of the country's largest electric equipment manufacturers — Allis-Chalmers and Westinghouse — will put specially designed railroad cars into operation this year. Cars will handle the biggest equipment they now manufacture.

Allis-Chalmers design features "well-center" railroad cars, each with 50-ton capacity. Condenser shell sections, measuring 10 by 18 by 30 ft, can be shipped to 40% of the U.S. in the new cars.

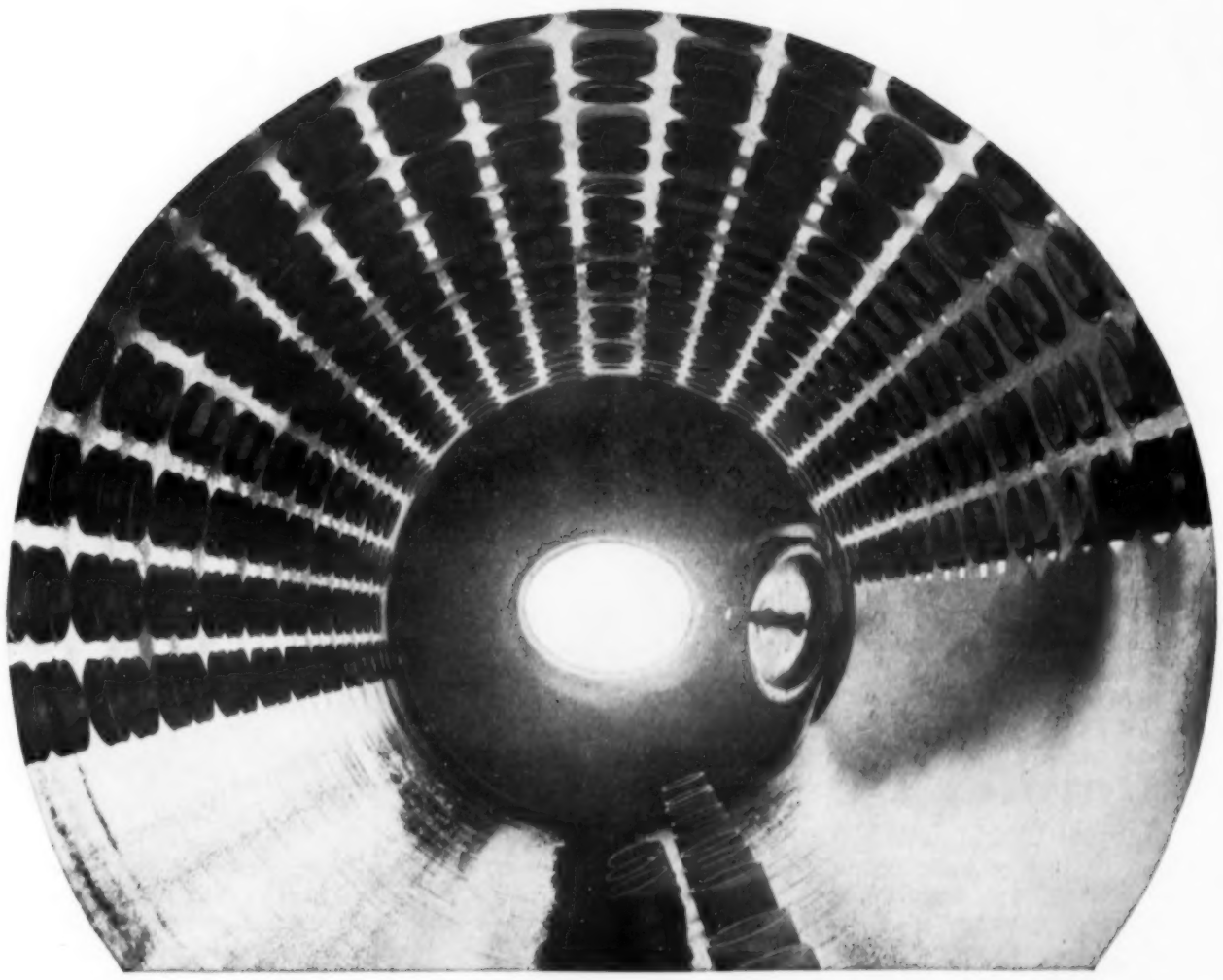
Westinghouse has designed a three-part railroad car, with the actual load acting as one part of the car. Load capacity will be 250 tons. Car will be able to transport a transformer 28 ft long and 12 ft wide.

Stockholders get "assist" in understanding annual reports

Glossary of business and engineering terms has been added to the 1956 annual report of the Fairchild Camera and Engineering Corporation. Says president Sherman M. Fairchild, "We are no longer taking it for granted that the average layman is a combination of Einstein and J. P. Morgan." Suggested by a company stockholder, glossary explains technical terms used in the annual report in commonsense English. Management, preoccupied with successful operation of their business, is likely to forget that the real owners of the company represent a cross section of America without technical background, but with common sense, Fairchild says.

Probes paint film thickness

New quality control instrument, the Laminagage, electronically measures paint film, electro-plating, or metal overlay down to one ten-thousandth of an inch, says its developers, General Motors Research Staff. Used where production items such as bearings or decorative plated surfaces must be kept within definite limits of thickness or thinness, Laminagage utilizes principle that distribution of an alternating electric current in an electrically conducting material is greatest at the surface and decreases as it penetrates beneath the surface. ♦ ♦



NOBODY WAS SURPRISED

When this mud drum was opened for inspection, it looked just as everyone expected it would—clean as a whistle, completely free of sludge and scale—after nine months of treatment with Dearborn Formula 659. That's product dependability.

Formula 659 contains a patented* Dearborn Polyamide Anti-Foam that provides protection throughout the entire water-steam cycle. In addition to improving steam quality, Formula 659 also conditions sludge, reduces blowdown requirements, and controls corrosion.

Compatible with other water treating reagents, Formula 659 is a neutral product which imparts no alkalinity to boiler water—nor will it increase carbon dioxide content of steam.

Formula 659 will mean important savings in your plant—see your Dearborn Engineer.

*U.S. Pat. No. RE-23085

HOW FORMULA 659 WORKS

FORMULA 659 improves steam quality by reducing carry-over to a minimum.

FORMULA 659 keeps sludge in a fluid, non-adherent form.

FORMULA 659 permits higher boiler water concentrations, thus reducing blowdown.

FORMULA 659 helps protect against corrosion in the water-steam cycle.

USE THE COUPON

Dearborn®

...a leader in water conditioning and corrosion control for 70 years

Dearborn Chemical Company, Dept. INP
Merchandise Mart Plaza, Chicago 54, Ill.
☐ Send complete details on Dearborn Formula 659.

Name.....*Title*.....

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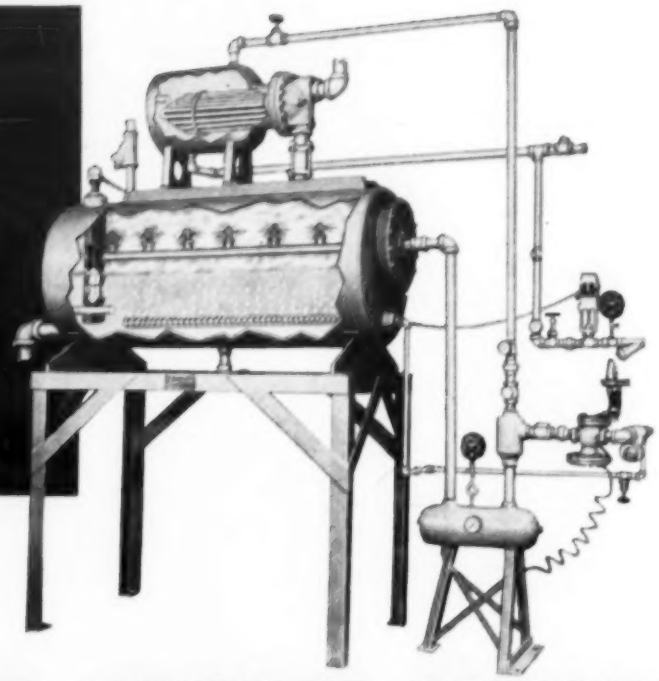
Circle 147 on READ-N-CIRCLE card for more data

SCHAUB

ZERO-OXYGEN DEAERATOR



TURNING AN OLD PRINCIPLE UPSIDE DOWN

Comes Up with a Better, Simpler Deaeration System

That is exactly what Schaub engineers did when they first designed the Schaub Zero-Oxygen Deaerator.

THE RESULT: An entirely new and simpler kind of boiler feedwater deaerator that insures complete oxygen removal (to .005 cc/liter) under all conditions and wide load variations—with excellent thermal economy. Add to this, lowest maintenance, plus complete safety and utmost dependability.

Basic differences that give Schaub Zero-Oxygen Deaerators their more effective performance are: 1) *external pre-heating* to a temperature *well above* boiling point within the deaerator; 2) explosive flash-down release of dissolved gases; 3) *unrestricted venting* through a special type vent condenser for faster *complete* release of liberated gases, without wasteful excess steam vapor losses.

By delivering *superheated* water into the fully vented tank, the hitherto critical problem of "matching" temperature to the *"full"* boiling point at the pressure within the deaerator is entirely eliminated. (This has been a major stumbling block with conventional deaerator design.) Passing through multiple, specially designed spray nozzles, incoming water "flashes down" in an explosive action that effectively liberates oxygen, CO_2 and all other non-condensible gases.

Also with unrestricted venting there is no need for premium-cost pressure shell. No pressure relief valve, overflow trap or orifice adjustment is ever required. Rust-proof Chromosoid lining insures extra-long life.

Before you plan any installation or addition of deaerating capacity get the full facts on all the performance advantages proved by the Schaub method. Ask your Schaub representative, or write for Bulletin 575.

FREE FACTS! MAIL THIS COUPON FOR COMPLETE DATA

FRED H. SCHAUB ENGINEERING CO.

2115 South Marshall Boulevard Chicago 23, Illinois

FRED H. SCHAUB ENGINEERING COMPANY
2115 South Marshall Boulevard, Chicago 23, Illinois

Please send me without cost or obligation my personal copy of your new Bulletin 575 on Boiler Feedwater Deaeration theory and practice.

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Industry Power

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Telephone: YUkon 3-5515

VOLUME 72 NO. 5 MAY 1957

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A PUTMAN PUBLICATION

Industry Power

FOR MEN WHO MANAGE POWER SERVICES

VOLUME 72 NO. 5 MAY 1957

In this issue . . .

air conditioning with back-pressure steam 14

RCA levels out its summer and winter loads by using steam to drive air-conditioning equipment. This keeps boiler plant efficiency high in summer when plant heating system is shut down.

sound diesel generator unit foundations 16

Shape of diesel engine equipment foundation often is haphazardly determined by building arrangement rather than proper foundation design. Discusses basic foundation types, when to use each.

activated carbon removes irritating vapors 18

Consolite Corp.'s Dandecal Division solves problem of annoying vapors from solvents in silk screening process by passing plant air through activated charcoal air filters.

power basics for today's industry engineering economics 20

Part IV — how to avoid booby traps. Essentials of engineering economic studies, including fixed charges (interest, taxes, depreciation, etc.); operating and maintenance costs; other contingencies.

how to apply reduced-voltage starters 22

Larger integral horsepower motors demand special attention when starting. This comprehensive rundown of the starting techniques available includes: resistance, reactance, autotransformer, part winding.

monthly features . . .

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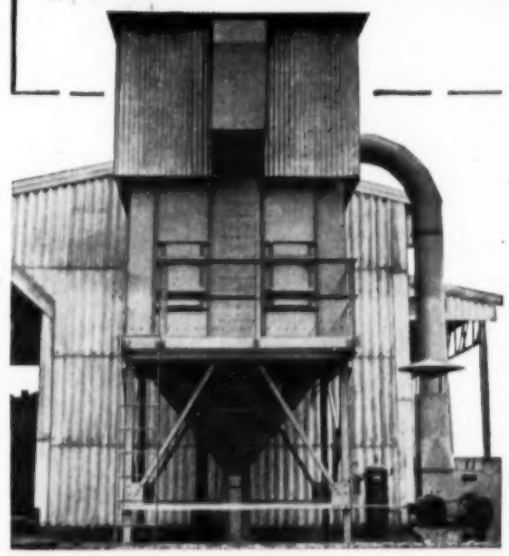
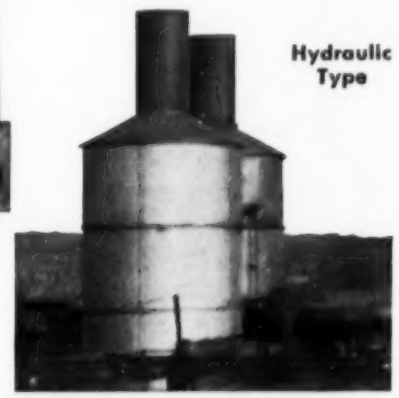
Make your air come clean!

Give Norblo the job of fitting one or more modern types of Collecting Systems to your Dust or Fume problems

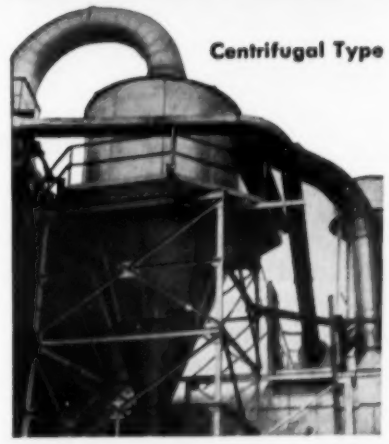


Automatic Bag Type

Clean air pays dividends —in employee health and comfort, in protection of work in process, and often, to reclaim valuable materials.



Hydraulic Type



Centrifugal Type

Norblo engineers and manufactures the three types of dust collecting equipment illustrated here in actual use. Norblo recommends the type or combination of types that will give you the best results at most economical cost.

High recovery at low operating and maintenance costs is assured by Norblo engineering and guaranteed performance . . . If you have a dust or fume problem, it pays you to consult Norblo.

The Northern Blower Company
6422 Barberton Ave., Cleveland 2, Ohio • OLympic 1-1300

Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

Circle 149 on READ-N-CIRCLE card for more data

nuclear news

. . . about industry power

SUPPORTS ATOMIC LIABILITY LEGISLATION

Francis K. McCune, General Electric's top atomic official supports pending Anderson-Price atomic liability legislation. He views legislation as a spur to industrial development of atomic energy and as protection for the public against financial loss in case of atomic accident. McCune, vice president and general manager of GE's Atomic Products division, told joint Congressional Committee on Atomic Energy, chances for large atomic catastrophe are "extremely small." "But," he stated, "public and industry must have financial protection for such an event. Government must provide to reactor operators, suppliers, and others, liability protection which cannot be covered by reasonably available private insurance."

BURNOUT TESTING OF REACTOR FUEL ELEMENTS STRESSED

Burnout testing of reactor fuel elements in water-cooled nuclear reactor operation was emphasized by T. W. Hunt, Bettis Atomic Power Division, Westinghouse Electric Corporation. Bettis presented paper before the Nuclear Engineering and Science Conference. Purpose of burnouts to destruction or near destruction is to provide knowledge of upper power limits that can be removed from a nuclear reactor. Electricity is used in testing burnout because of the ease and accuracy with which it can be applied and measured.

THIRD "MASS PRODUCED" REACTOR GOES CRITICAL

Third training and research reactor (AGN 201) made by Aerojet-General Nucleonics, San Ramon, Calif., recently went critical with 654 grams of U-235, 20% enrichment. AGN 201 is the first "mass produced" reactor, and the only operating reactor judged safe enough by AEC to operate in existing buildings in heavily populated areas, says Aerojet's Robert Mainhardt. Aerojet-General Nucleonics shipped an AGN 201 reactor to the recent International Atomic Exposition, Philadelphia. Entire reactor system, less fissionable core material, was shipped via

Users Say R/M BELTS AND HOSE

It's *Poly-V*® . . . and Trouble-Free!

Major causes of drive trouble have been engineered *out* of R/M's patented, new Poly-V Drive. Because it employs a single, endless V-ribbed belt running on sheaves specially designed to mate precisely with the belt ribs, Poly-V delivers more power per inch of drive width than ever before possible! R/M Poly-V delivers up to 50% more power than an ordinary V-belt drive of equal width . . . equal power in as little as ⅔ the width. This means *narrower sheaves . . . less shaft overhang . . . less drive weight* on heavy duty power driven equipment.

R/M Poly-V's single unit belt design also eliminates "length matching" problems and downtime for belt replacements. Poly-V belt speed ratio and belt position remain constant from no load to full load to run smoother and cooler — with *less wear* on belt *and* sheaves! Just two cross sections of Poly-V belt meet *every* heavy duty power requirement: belt and sheave inventories are cut to a new low!

An R/M representative will show you other features of Poly-V* Drive that add up to longer, trouble free service for every heavy duty power drive application.

Write for Bulletin #6638

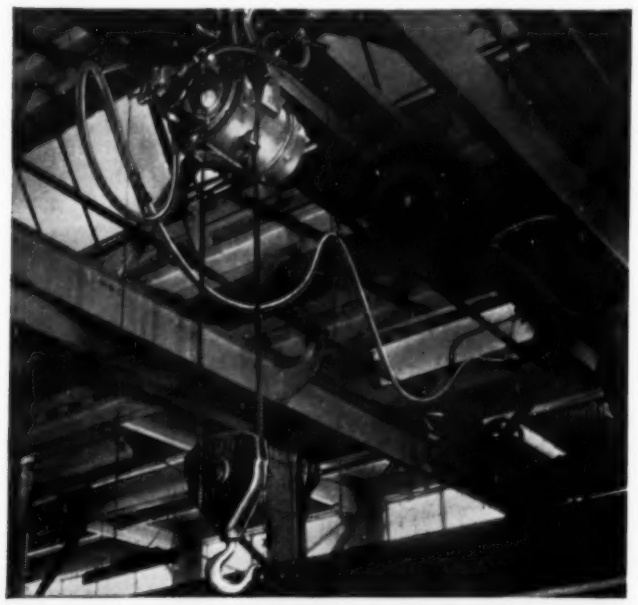
And . . . for the "Smoothest Running V-Belts Made" Specify R/M CONDOR and SUPER-POWER V-BELTS

Circle 128 on READ-N-CIRCLE card for more data

Give You "More Use per Dollar"

Allflex Hose—Light, Strong, "Flexible as a Rope"!

This new R/M hose offers a degree of rugged strength with light weight and flexibility not possible with ordinary all-purpose constructions. Allflex hose coils and uncoils freely in *any* direction . . . *without kinking*. Uniform inside and outside diameters permit faster, easier, *safer* coupling. You can't find a longer lasting, easier handling hose for use with air, water, oil and gases—even mild chemicals!



R/M makes a complete line of quality hose for special services, too. Whatever your requirements, you get more use per *hose* dollar from R/M.

Write for Bulletin #7075

R/M Puts the "Extras" in Conveyor Belt Design!

For the conveyor belt *engineered* for your particular job, investigate R/M's advanced developments in heavy duty belt design . . . constructions like extra flexible Ray-Man . . . which trains naturally, troughs easily . . . handles *fuller, heavier* loads even where small pulleys are required in low-head room installations . . . extra-cushioned Homocord, for unusually abusive shock loading . . . R/M Tension-Master for extra long lifts and high tensions. Each belt is mildew-proof and moisture resistant . . . and each is protected by the exclusive "XDC" Cover, R/M's *bonus* extra to greatly increase resistance to wear, tear, cuts and abrasion. *Specify* R/M Conveyor Belts . . . you *get* "More Use per Dollar."

Write for Conveyor Belt Bulletins

RM 715

BELTS • HOSE • ROLL COVERING • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

Circle 128 on READ-N-CIRCLE card for more data

commercial truck lines. Arrangements were made to fly fissionable core assembly to the exhibit city by routine passenger airline flight.

AEC OPENS CLASSIFIED LIBRARY IN NYC

Classified depository library to serve needs of access permittees and AEC contractors has been opened at AEC's New York City operations office. Library is first of several planned for other regions to facilitate access by cleared personnel to classified technical information.

NO HANDS NEEDED TO CHANGE NUCLEAR FUEL ELEMENTS

Remote handling equipment will be used to remove nuclear fuel elements for examination, replacement at Duquesne Light Company's Shippingport plant, world's first full-scale atomic power plant for civilian use. Nuclear core with uranium fuel charge is housed inside 250/ton, 9-inch thick steel pressure vessel. Shrouds extending through top of pressure vessel will contain neutron-absorbing control rods, enable engineers to speed up or slow down atom-splitting, heat producing process. Westinghouse engineers designed nuclear portion of the plant for AEC.

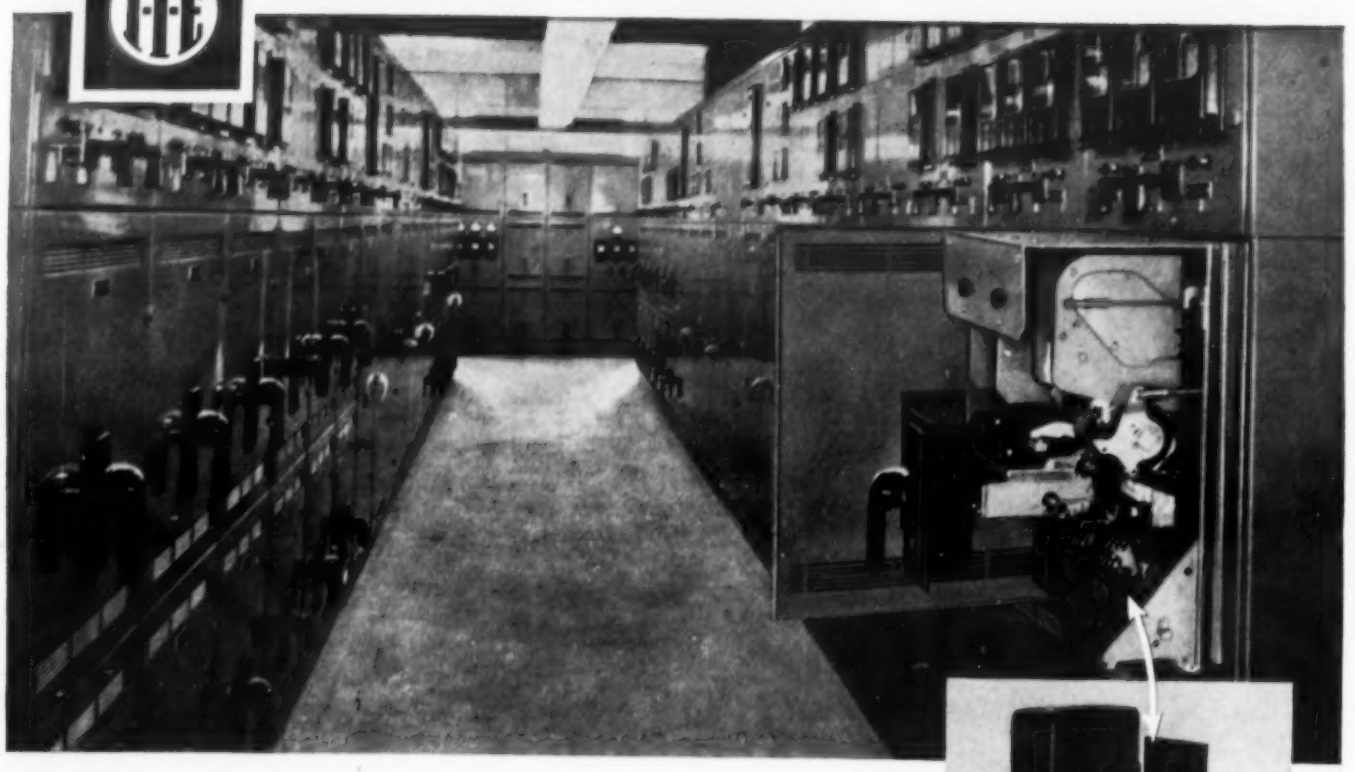
AEC ENLARGES WORK EXPERIENCE PLAN

Program for privately employed nuclear scientists and engineers to gain specialized work experience in AEC plants and laboratories has been enlarged as aid to further development, use of atomic energy for peaceful purposes. AEC's primary purpose is to aid those generally educated and trained in nuclear science to become familiar with specific uses. Until a diversified private industry is developed, necessary training, experience can be gained only in AEC facilities.

TELLER SUGGESTS NEW NUCLEAR PHYSICS CONCEPTS

Two new nuclear particles and some attendant theoretical concepts in nuclear physics have been advanced by Dr. Edward Teller, professor of physics at University of California. Teller and a group of colleagues at Berkeley suggested the new concepts in an effort to better explain nuclear forces. ♦ ♦

LOW VOLTAGE SWITCHGEAR

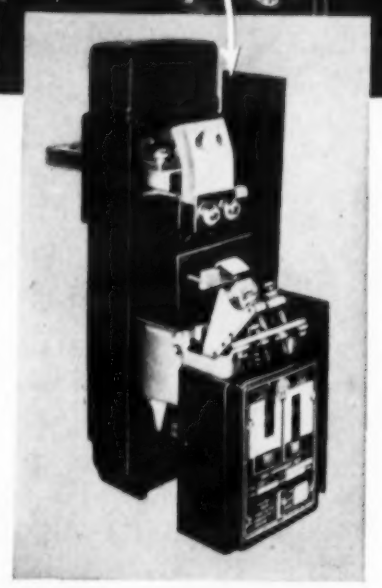


Here's SENSITIVE Circuit Protection

Some temporary overcurrents are tolerable; should even be permitted to occur. But sensitive circuit protection is needed to interrupt them when they persist too long or are of too high a magnitude.

The I-T-E Type OD-1 dual magnetic overcurrent trip device gives such protection. It permits temporary overcurrents, but limits them in duration and magnitude. This device will trip the circuit breaker after a predetermined interval on relatively low overcurrents or will trip instantaneously on high-magnitude fault currents. In either case you get safe, positive protection—sensitive to the needs of the circuit and the equipment on it.

For complete information on sensitive circuit protection, including selective tripping, undervoltage and other tripping devices, contact your local I-T-E sales representative. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.



Features of the I-T-E Type OD-1 Trip Device

PRECISION BUILT and factory calibrated to provide the highest possible accuracy in operation.

SEALED SILICONE TIMING ELEMENT. No maintenance. No oil to handle, no level to maintain, no sludging.

QUIET. Resonant vibration dampeners prevent a-c noise and wear on parts.

COMPLETELY ADJUSTABLE IN SERVICE. The delay pickup is easily adjusted from 80 to 160% of the continuous current rating. The instantaneous pickup is adjustable from 500 to 1500% of the continuous current rating. The time delay is adjustable to any of three time delay bands—minimum, intermediate and maximum.

SAFE DEAD FRONT DESIGN. Insulated knobs permit safe adjustment on a *hot* circuit breaker.

DEPENDABLE impact tripping action. The *hammer blow* movement of the time delay armature at end of timing stroke gives positive operation.

FAST RESETTING. Sensitive check valve on the piston provides quick resetting of the time delay. Repeat tripping is assured.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES, LTD.

Circle 108 on READ-N-CIRCLE card for more data

late news

. . . about industry power

• First gas turbine in rubber

DENVER, COLO. — First gas turbine in the rubber industry, with a generator rated at 5000 kw, has been placed in operation by Gates Rubber Company here.

William Campbell, Gates power plant superintendent, adjusts controls of the new unit, built by General Electric Company. Unit generates plant electricity, also supplies heat to make process steam in heat recovery boiler.

• Engineers are aristocracy of necessity

Engineers "have become the aristocracy of necessity," says M. S. Coover, President of AIEE. Coover points out that industry depends on engineers for a steady stream of new, diversified products so that business can continue to be both the mainspring and balance wheel of the nation's economy. Society depends on them for national survival through their ingenuity to develop, produce and deliver instruments of destruction if need be. "Thus," Coover emphasizes, "engineers have become a commodity in short supply in some areas. Perhaps it can be stated quite fairly that they have become the aristocracy of necessity."

• Largest air-source heat pump to be installed

Largest of its kind, a 550-ton York compound compression air source heat pump system will be installed in the new ten-story Columbus and Southern Electric Company home office building, Columbus, O. System will cool the 180,000-sq ft building during summer and will use outside air as a heat source during winter. No supplementary electric heating or conventional fuel-fired boilers will be used. Edgar I. Williams is architect, with Ebasco Services, Inc., as engineers and constructors for the project. Completion date is set for early 1958.

• Sound level drops 19.6 decibels

Transformer sound level reduction of 19.6 db is result of Niagara Mohawk Power Corporation's installation of new 5000-kva transformer in pre-fabricated, tailormade sound enclosure. Oil-filled, load-tap-changing unit was specifically engineered for Niagara Mohawk by General Electric's Medium Transformer department. This is the first integrated transformer and sound enclosure capable of being fully assembled and pretested at the factory.

• AIEE's insulation standard to be revised

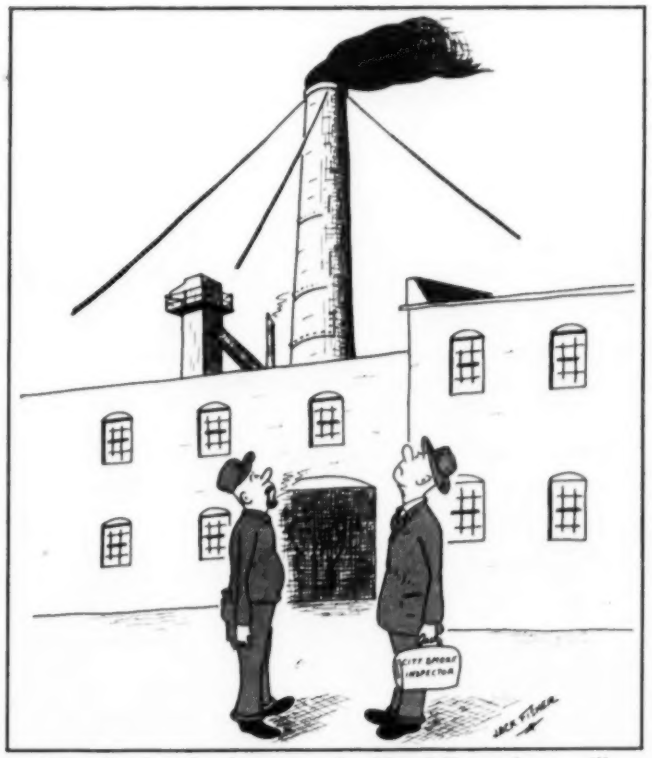
Revision of AIEE's Standard No. 1 on insulation will be published in June, according to M. L. Manning, McGraw-Edison Company. Chemical discoveries, rapid expansion of electric power, and demand for smaller electric equipment that creates need for new insulation concepts caused need for the revision, Manning said.

• Electrical manufacturers lead the way

U. S. electrical manufacturers are spending 20% of all money earmarked by American industry for research and development programs today says Gwilym A. Price, chairman and president, Westinghouse Electric Corporation. "Either for their own or for contract projects, electrical manufacturers are spending about 6% of their sales income on these programs," Price stated. Speaking before a dinner meeting at the recent American Power Conference in Chicago, he concluded that the "research dollar" is the most valuable dollar being spent today. Technical break-throughs may open up whole new avenues of expansion and advance.

• Turbines will help control Missouri

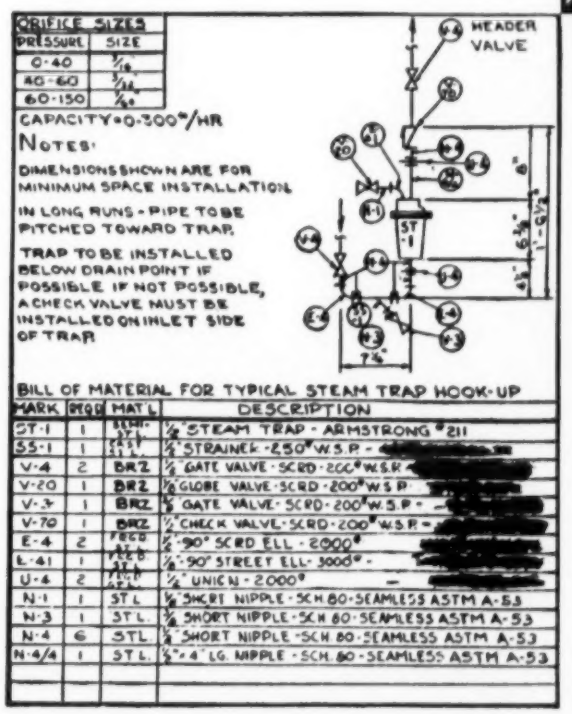
A $10 million plus order for seven hydraulic turbines has been placed with Allis-Chalmers Manufacturing Company by U. S. Army Corps of Engineers. They are destined for Oahe Reservoir project, marking another step in controlling the Missouri River. When installed, the seven will provide an additional 900,000 hp to the west north central section of the U. S. First turbine is scheduled for shipment in mid-1960, with completion of project set for late 1962. ♦ ♦



"So that's what's meant by No. 5 Ringelmann!"

How Steam Trap Standardization *reduces Installation and Maintenance Work and Cost*

No Bypasses Needed. Traps can be replaced in a couple of minutes by uncoupling the unions and installing a "spare" trap complete with proper length pipe connections and half unions.


ORIFICE SIZES
PRESSURE | SIZE
0-40 | 7/16
40-60 | 3/64
60-150 | 1/40
CAPACITY-0-300#/HR
NOTES:
DIMENSIONS SHOWN ARE FOR MINIMUM SPACE INSTALLATION
IN LONG RUNS - PIPE TO BE PITCHED TOWARD TRAP.
TRAP TO BE INSTALLED BELOW DRAIN POINT IF POSSIBLE IF NOT POSSIBLE, A CHECK VALVE MUST BE INSTALLED ON INLET SIDE OF TRAP.
HEADER VALVE
ST-1
7"
1'-9½"
6½"

BILL OF MATERIAL FOR TYPICAL STEAM TRAP HOOK-UP

MARK	REQD	MAT'L	DESCRIPTION
ST-1	1	[illegible]	½" STEAM TRAP - ARMSTRONG #211
SS-1	1	[illegible]	½" STRAINER - 250# W.S.P. - [illegible]
V-4	2	BRZ	½ GATE VALVE - SCRD - 200# W.S.P. - [illegible]
V-20	1	BRZ	½ GLOBE VALVE - SCRD - 200# W.S.P. - [illegible]
V-3	1	BRZ	½ GATE VALVE - SCRD - 200# W.S.P. - [illegible]
V-70	1	BRZ	½" CHECK VALVE - SCRD - 200# W.S.P. - [illegible]
E-4	2	FGCD MALL.	½" 90° SCRD ELL - 2000#
E-41	1	FGCD MALL.	½" 90° STREET ELL - 3000# - [illegible]
U-4	2	[illegible] MALL.	½" UNION - 2000# - [illegible]
N-1	1	STL	½ SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N-3	1	STL	½ SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N-4	6	STL	½ SHORT NIPPLE - SCH 80 - SEAMLESS ASTM A-53
N-4/4	1	STL	½" × 4" LG. NIPPLE - SCH. 80 - SEAMLESS ASTM A-53

Standardized hookup includes test valve for trap testing, strainer, blowdown valve for cleaning trap, shut-off valves and unions for quick replacement.

Trap Maintenance Costs Reduced $25,000 per Year with Armstrongs

Major reductions in steam trap installation and maintenance work and cost can be achieved by standardization on one make of trap which, in turn, permits standardized hookups. A major chemical company reports an annual maintenance saving of $25,000 since installing 4000 Armstrong traps according to the drawing and photograph shown here. Additionally, trap parts inventory is reduced and purchasing is simplified.

Traps of a Size Interchangeable. Note that exact dimensions are given for the pipe fittings, including nipples connected to each size of trap. When a trap needs repair, the unions can be uncoupled, the trap lifted from the line, and a "spare" carrying identical pipe connections slipped in place. In as little as one or two minutes, a faulty trap is replaced. It is then repaired and takes its place as a "spare".

$25,000 Trap Maintenance Saving. Records on the Armstrong trap installation described here show that the cost of repair parts was approximately $10,000 less annually than with the traps previously used. Reduction in maintenance labor brings the total saving to $25,000, per year. *And, fuel savings attributable to the traps are at least equal to the maintenance saving.*

FOR COMPLETE INFORMATION on the traps that slash maintenance costs ask for the Armstrong Steam Trap Book containing complete data plus selection, installation and maintenance recommendations. Call your local Armstrong Representative or write.

ARMSTRONG MACHINE WORKS, 8207 Maple Street • Three Rivers, Michigan

ARMSTRONG STEAM TRAP

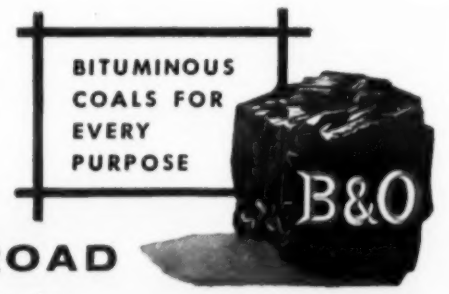
ARMSTRONG STEAM TRAPS

Circle 125 on READ-N-CIRCLE card for more data

➔ Take a long look into the future. You'll see constantly growing industrial activity and millions of tons of *power-packed* Bituminous produced to sustain it, with *billions* still in reserve! B&O is a keystone to this vital supply and demand. The coal fields it serves hold proved, usable reserves of billions of tons of Bituminous for every purpose.

Today, tomorrow or decades ahead you may be sure that B&O Bituminous can be *your* best source of stable-low-cost power. It will pay you to use this *fuel with a future* NOW! *Ask our man!*

CONTACT OUR COAL TRAFFIC REPRESENTATIVE!
You'll receive details in the most efficient, low-cost Bituminous coal for your particular requirements.
COAL TRAFFIC DEPARTMENT B&O RAILROAD
Baltimore 1, Md. LExington 9-0400



BALTIMORE & OHIO RAILROAD

Circle 139 on READ-N-CIRCLE card for more data

Industry Power

Shepard-Benning Building, Saint Joseph, Michigan
Telephone: YUkon 3-5515

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- Advertisers' nearest sales and service offices are indexed alphabetically. See pages 53 and 54.
- Advertisements are indexed by products in handy guide. See page 49.
- Important literature is indexed by products. See page 35.

this month's comment . . . .

. . . lost profits in the boilerhouse

In our editorial trips each month we find and report on a great many improvements made by industrial plants. The most striking improvements we find in the *distribution* and *use* of electricity, steam, compressed air, and other power services.

But, in the *production* of these, particularly steam, we find that the boilerhouse — source of power services that enable your plant to operate — often times is sadly neglected.

Our observations are confirmed by the surveys referred to by J. E. Tobey, president of Appalachian Coals, Inc., in his Forum article this month.

Frankly, the efficiencies as well as the morale of too many boilerhouses are low compared to the production and processing operations.

Why? I think the finger must be pointed at you in management who have failed to recognize that there are *profits in the boilerhouse* just as there are profits in manufacturing and processing.

The cost of supplying steam, for example, to your processing operations is as important a cost as that of raw materials and product components. In fact, you can predict directly how investments made to achieve lower steam costs will pay off.

To get steam, you can't shop around for a different supplier. You can't use a substitute. But you can lower your product cost if you spend time and money investigating improvements and changes.

Steam, electricity, water, etc. are *requirements* for plant production operations. They must be dependable, and they must meet specifications in order for your plant to use them economically and efficiently.

Take another look at your boiler room. It will pay off — in better production, better employee morale, and in dollars and cents.

John Paul Taylor

John Paul Taylor
Editor and Publisher

Dust Particle
with a mission

. . . to pollute the atmosphere and damage valuable equipment.

Flyash control is more important today than ever before in history because of the ever increasing number of industrial plants in operation. Each type dust has its own physical, chemical and electrical properties. To design dust collection equipment to capture these particles requires basic knowledge of the importance of these variables to the overall problem.

The Aerotec Corporation is experienced in the quantitative measurement of all dust properties and is equipped to carry out these tests before a recommendation for equipment is ever made. This ability, plus the most advanced design of both mechanical and electrostatic dust collectors, makes The Aerotec Corporation the logical choice to solve your dust collection problems.

Our Project Engineers, located in most principal cities in the United States and Canada, will be happy to supply you with information and literature on either mechanical, electrostatic or series dust collectors.

Project Engineers **THE THERMIX CORPORATION** Greenwich, Conn.
(Offices in 38 principal cities)
Canadian Affiliates: T. C. CHOWN, LTD., 164 Metcalfe Ave., Westmount, Montreal 6, Que.
Manufacturers
THE AEROTEC CORPORATION
Greenwich, Conn.

Circle 132 on READ-N-CIRCLE card for more data

names make news

. . . personalities from industry power

Allis-Chalmers Manufacturing Co. names **R. M. Casper** general manager of new Nuclear Power Division for development of atomic energy equipment.

Seelye Stevenson Value & Knecht, N. Y. consulting engineers, announce new firm associates: **Williams D. Bailey,** Civil Engineering Division; **Frohman P. Davis, Ira M. Hooper, Frederick J. Kircher, Philip P. Page, Jr.,** and **Wayman C. Wing,** Structural Engineering Division; **William T. Cleland, Jack N. Keck, Alexander Michelson, Jr.,** Mechanical and Electrical Engineering Division.

The Bird-Archer Co. elects **Charles W. Bird, Jr.** president. Retiring president is **H. C. Harragin.**

Walter

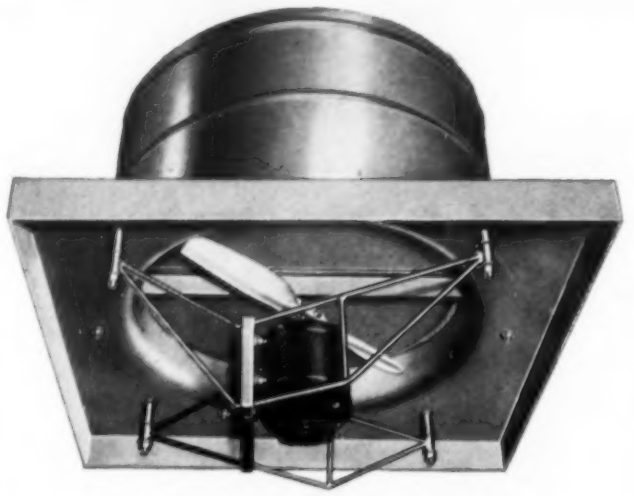
Nielsen

Goodyear Tire & Rubber Co. honors **A. B. "Dutch" Walter,** who completes his 25th year with Goodyear. A coal miner since he was 15, Walter pioneered in belt conveyor use in mines.

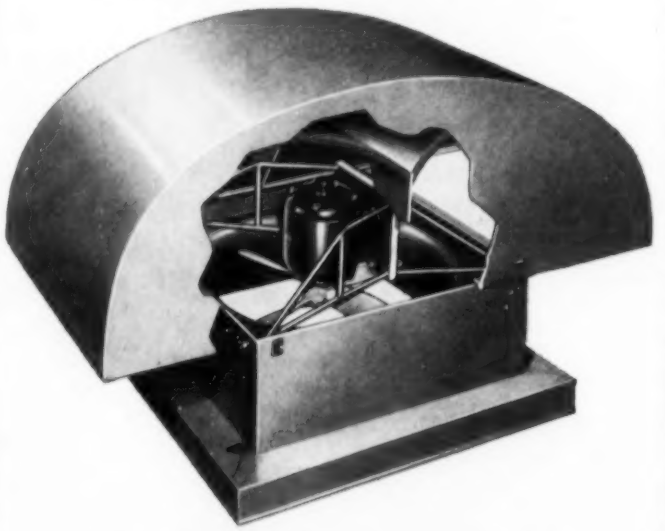
Babcock & Wilcox Co. elects **M. Nielsen** president, succeeding **Alfred Iddles,** who retires after nine years as B&W head. Nielsen joined B&W in 1924 as a construction worker. He was subsequently raised to district inspector, production superintendent, executive assistant and in 1955 to executive vice president.

American Power Conference presents Certificate of Merit to **Dr. Walter H. Zinn,** former Argonne National Laboratory director and current General Nuclear Engineering Corp. head. Certificate is for contributions in nuclear power generation and pioneering achievements in atomic research. **Dr. Norman Hilberry,** former deputy director at Argonne, succeeds Zinn as director.

Department of Commerce appoints **Carl O. Friend** director of Power Equipment Division, Business and Defense Services Administration. He represents **Diesel Engine Manufacturer's Association** under current rotation system in which leading industry representatives serve without pay for 6-month period. Friend is administrative manager of Nordberg Manufacturing Co.'s Heavy Machinery Division. ♦ ♦



HARTZELL VERTIJET — Windband formed from 20 gauge galvanized steel, base from 14 gauge zinc-grip coated steel. Fan ring is integral part of base sheet. Two semicircular galvanized lids at base of windband open automatically when fan goes on, close weather-tight when it goes off. Throat sizes from 18" to 60"



HARTZELL REVERSIBLE ROOF VENTILATOR—One unit does the job of two conventional one-way ventilators. This unit moves air in either direction with equal efficiency; you convert from intake to exhaust at the flick of a switch. Throat sizes from 28" to 44".

Why You Can Count on Hartzell Air-Moving Equipment for Long Life, Rugged Reliability and Minimum Maintenance

Hartzell fans and blowers are engineered and built for the exacting requirements of tough industrial service. There's no compromise with quality for the sake of shaving a few dollars on price. Hartzell fans are designed for the industrial buyer who is willing to pay for long life, dependable service and low maintenance.

Design Simplicity

OF **HARTZELL**

roof ventilators

means . . .

HIGH EFFICIENCY . . .

These Hartzell roof ventilators expel large volumes of heat, smoke and fumes quickly and efficiently because simplified design reduces obstructions to air flow. There's no maze of interior braces and supports. And all Hartzell roof ventilators are tested for performance in accordance with Standard Test Codes of the American Society of Heating and Air Conditioning Engineers.

LOW INITIAL COST . . .

Elimination of complications of design and construction produce savings in production costs which are passed along to you. Hartzell design simplicity means that Hartzell roof ventilators can offer top quality construction for long life and dependable service at a price much lower than that of more complex designs.

MINIMUM MAINTENANCE . . .

By minimizing the number of moving parts Hartzell reduces the number of things that can go wrong. Lids on vertical discharge models are mounted on corrosion resistant brass rods which turn on heavy Micarta plastic bearings which require no lubrication . . . won't stick, won't rust. Fan motors are ball-bearing type, conservatively rated for continuous performance. Under normal operating conditions, the only maintenance required will be periodic motor lubrication.

Write today, or ask your nearby Hartzell field engineer for a copy of the free Bulletin A-112A. It contains all the specifications for the two roof ventilators pictured, as well as for Hartzell's Airjet, Rotary and Penthouse roof ventilators.

HARTZELL
PROPELLER FAN CO.
Div. of Castle Hills Corp.
202 Thomas Blvd. • Piqua, Ohio

ENGINEERING OFFICES IN PRINCIPAL CITIES

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Industry Power

FORUM

A renaissance is needed in management attitude

JULIAN E. TOBEY, President
Appalachian Coals, Incorporated
with H. A. Bergen, Editor

About Julian E. Tobey

Julian E. Tobey received his education at Michigan State University and United States Naval Academy. He served as a senior engineering officer assigned to battleship duty during World War I. Tobey began his business career as a mechanical engineer. He was chief engineer of power plants for 12 years (1922-1934) with the Studebaker Corporation of America, South Bend, Indiana.

Tobey joined Appalachian Coals in 1934 as manager of Fuel Engineering Division. In 1940 he was elected vice president in charge of engineering. During this period he inaugurated a comprehensive series of fuel engineering conferences to coordinate common interests of coal producers, consumers, and equipment manufacturers.

In 1942 Tobey established and set up the Fairmont Coal Bureau, which he served as managing director until his return to Cincinnati in 1948. During World War II, he assisted in the mobilization effort as a consultant and as an active participant in many of the programs concerning fuel conservation.

Tobey is first vice president, a member of the Board of Directors, and former chairman of the Technical Advisory Board of Bituminous Coal Research, Inc. He has also served as chairman of the Coal Division of AIME and as chairman of the Fuels Division of ASME. In 1949 he was elevated to the grade of Fellow in ASME. In 1950 he received the Percy Nicholls Award, the highest award jointly sponsored by the ASME and AIME. For contributions to industry-sponsored coal research he received the 1955 Annual Award of Bituminous Coal Research, Inc. He is a member of NAPE. A professional engineer registered in Ohio, he served on the State Board of Registration for Engineers and Surveyors. In February 1956 Tobey was elected a director of the Air Pollution Control Association and was appointed to the Nuclear Energy Committee, National Association of Manufacturers.

LET THERE BE NO MISTAKE about it .... well over one third of this country's industrial boilerhouses are substandard. This is confirmed by the reports of the Coal Producers Committee for Smoke Abatement, whose engineers have surveyed thousands of smoking plants in more than 200 cities in the interest of smoke reduction and improved operating economy. They say, "It is not unusual to find the following to exist on surveys of this type:

Plants smoking at time of visit	50%
Plants expected to smoke	85%
Operation unsatisfactory	70%
Maintenance unsatisfactory	60%
Equipment overloaded	25%
Equipment obsolete	20%

Deficiencies found in many below-par power plants are almost too numerous to mention. We cite the following to name a few:

- Inadequate draft due to defective or overloaded chimneys, leaky breechings due to rust or open joints, leaky boiler settings and furnaces due to cracks, and fouled heating surfaces that restrict draft.
- Excessive draft due to poor damper controls, too much air, low CO_2, and low boiler efficiency.
- Burned out grates due to holes in the fuel bed, poor operation, and/or poor fuel selection.
- Worn out stoker feeding mechanisms.
- Slag formations on furnace walls due to improper firing or poor fuel selection.
- Poor stoker operation because of other factors such as worn out stoker control mechanisms and draft controls.
- Warped, ill-fitting and broken furnace and ash pit doors.
- Coal and ash-handling systems in bad state of repair.
- Coal segregation in bins, bunkers, hoppers, and storage yards."

When you stop to think, it seems almost incredible that situations involving such serious neglect of many steam plants could prevail. There is no evading the fact that this reflects on our engineering profession. Who can be responsible .... in one way or another .... for the fortunes of a steam plant but an engineer?

Somewhere along the line, we have missed the boat .... considering the fact that our institutions of higher learning have turned out literally tens of thousands of engineers. A large portion of these are mechanical engineers who took courses in combustion and steam generation and who were supposed to be fairly well grounded in the principles of steam plant operation. Certainly, there are mechanical engineers in most industrial plants who could exercise some supervision over their companies' steam plants. Even though their regular duties confine them to other engineering activities, it would seem that the best interests of management demands that they take time out now and then to inspect the steam plant and make recommendations for its efficient operation and maintenance. It appears that a lot of good talent is being wasted.

Great need exists for a renaissance in the upkeep and operation of our existing industrial boilerhouses .... and for a renaissance in management attitudes toward the true importance of power-producing equipment to production capabilities. Let's realize that we are not talking about something of small magnitude. To be specific, estimated coal consumption of industrial plants in 1956 (excluding utilities, coke ovens, and retail) was 95,650,000 tons. To this probably can be added another 10 million tons delivered by retailers to small offtrack industrial and commercial plants. We can assume about 106 million combined tonnage. Here, with more than 100 million tons, we are dealing with a total delivered cost in the neighborhood of one billion dollars.

Extensive surveys over a period of years indicate

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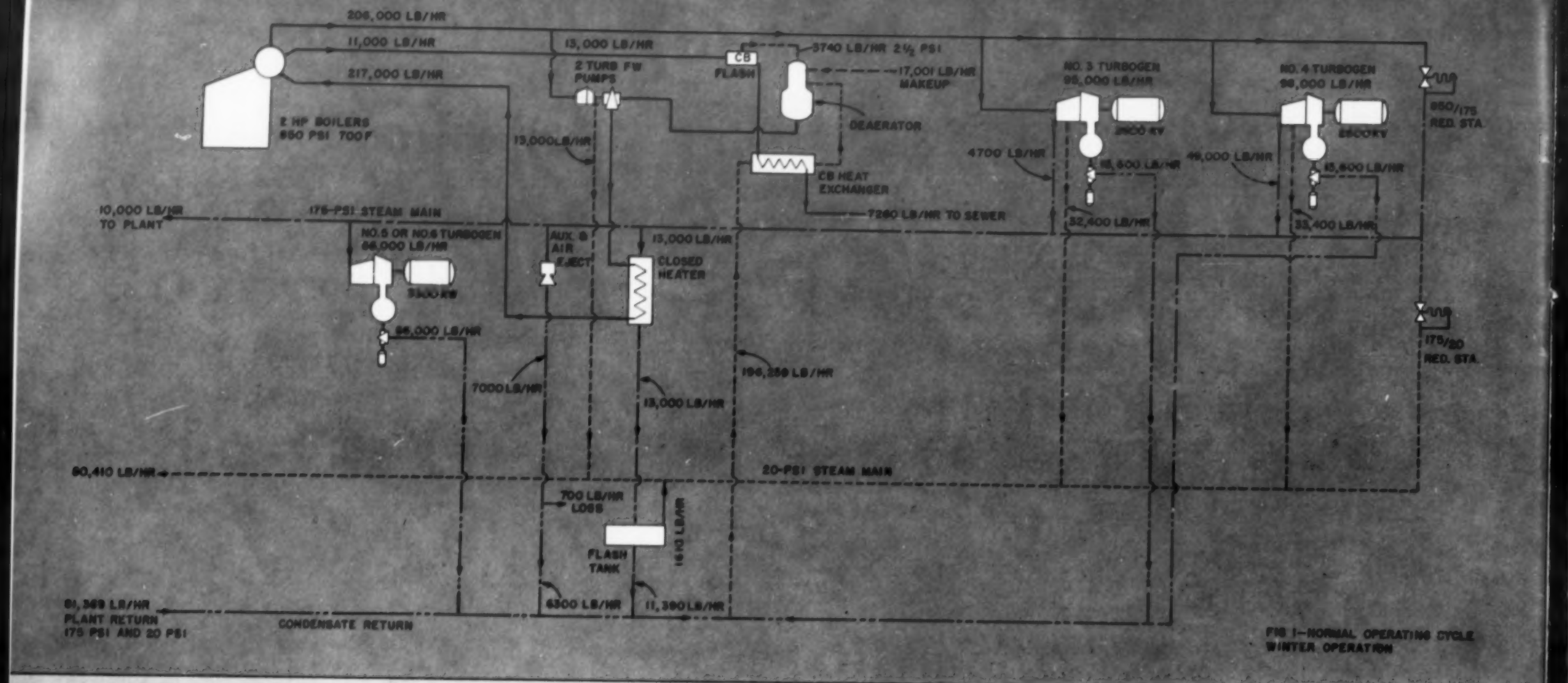


FIG 1—NORMAL OPERATING CYCLE WINTER OPERATION

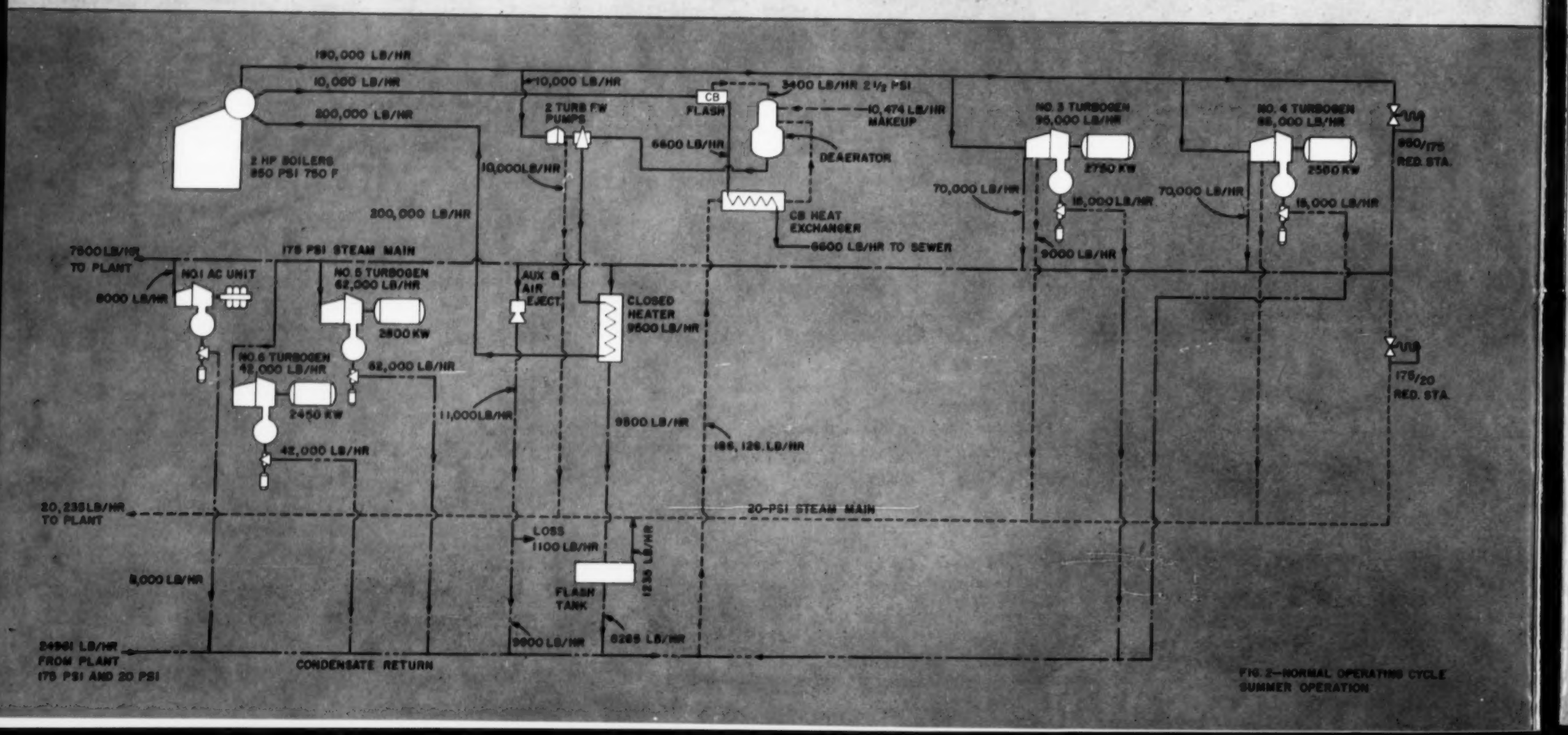


FIG. 2—NORMAL OPERATING CYCLE SUMMER OPERATION

RCA wanted to level out
their winter and summer steam loads.
They achieved it by . . .

Air conditioning with back-pressure steam

JOHN S. COLE
Manager, Power Services
Radio Corporation of America, Camden, N. J.

John S. Cole has been with RCA for six years. He graduated from the U.S. Coast Guard Academy New London, Conn. and served at sea. He came ashore in 1934 as a boiler inspector for Hartford Steam Boiler Inspection and Insurance Company. Later, he was maintenance engineer for Socony Vacuum at Paulsboro, N. J. He has taught electric generation at Rutgers University. John Cole's favorite hobby is stamp collecting—he has won two awards for his Canadian collection. Right now, he is busy after hours acting as a free-lance consultant on the renovation of a derelict fire house into a modern Masonic Temple for his lodge. The building has the lowest fire rating, too. He also works on Collingswood Citizens Committee on Education.

WITH EXPANDING air-conditioning requirements for both product control and personnel comfort, the power engineer now has a good opportunity for balancing his steam requirements on a year-round basis. Such a condition has developed at RCA's Camden, N. J. plant in the past few years.

Since steam cost that is charged to power generation makes up more than 50% of power generating cost, this is a good place to look for potential savings. The best way to reduce steam quantity chargeable to generation, is to look for more uses of either back-pressure or extraction steam.

In winter, an exceedingly favorable heat balance may be obtained by using high-pressure steam generation with extraction or back pressure turbines. Unit cost of distributed power is much less than purchased power. In summer, loss of heating steam load causes an unfavorable swing in the heat balance, with an attendant increase in power cost. Steam that was charged to heating now must be either condensed or

(continues on page 38)

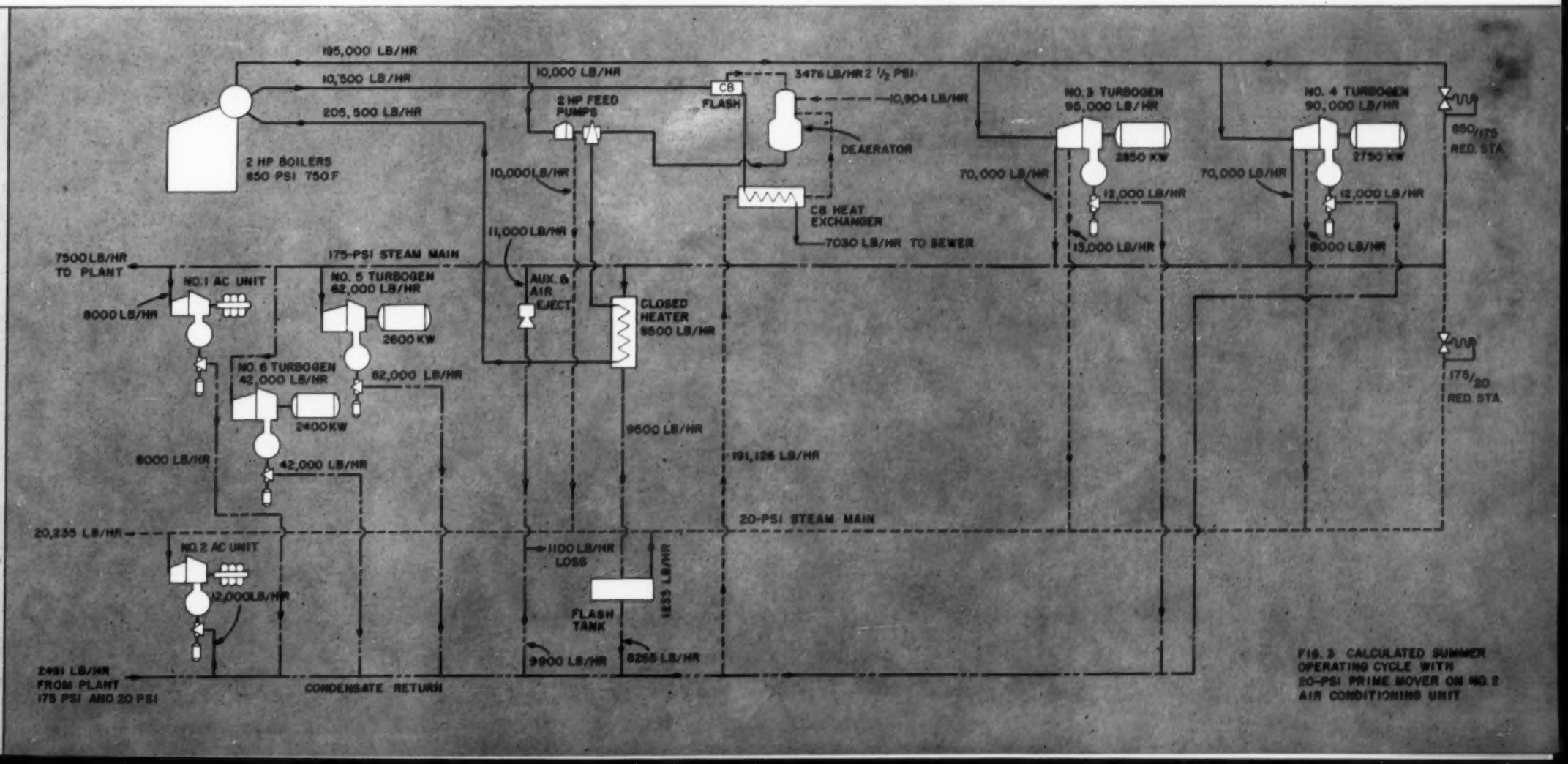
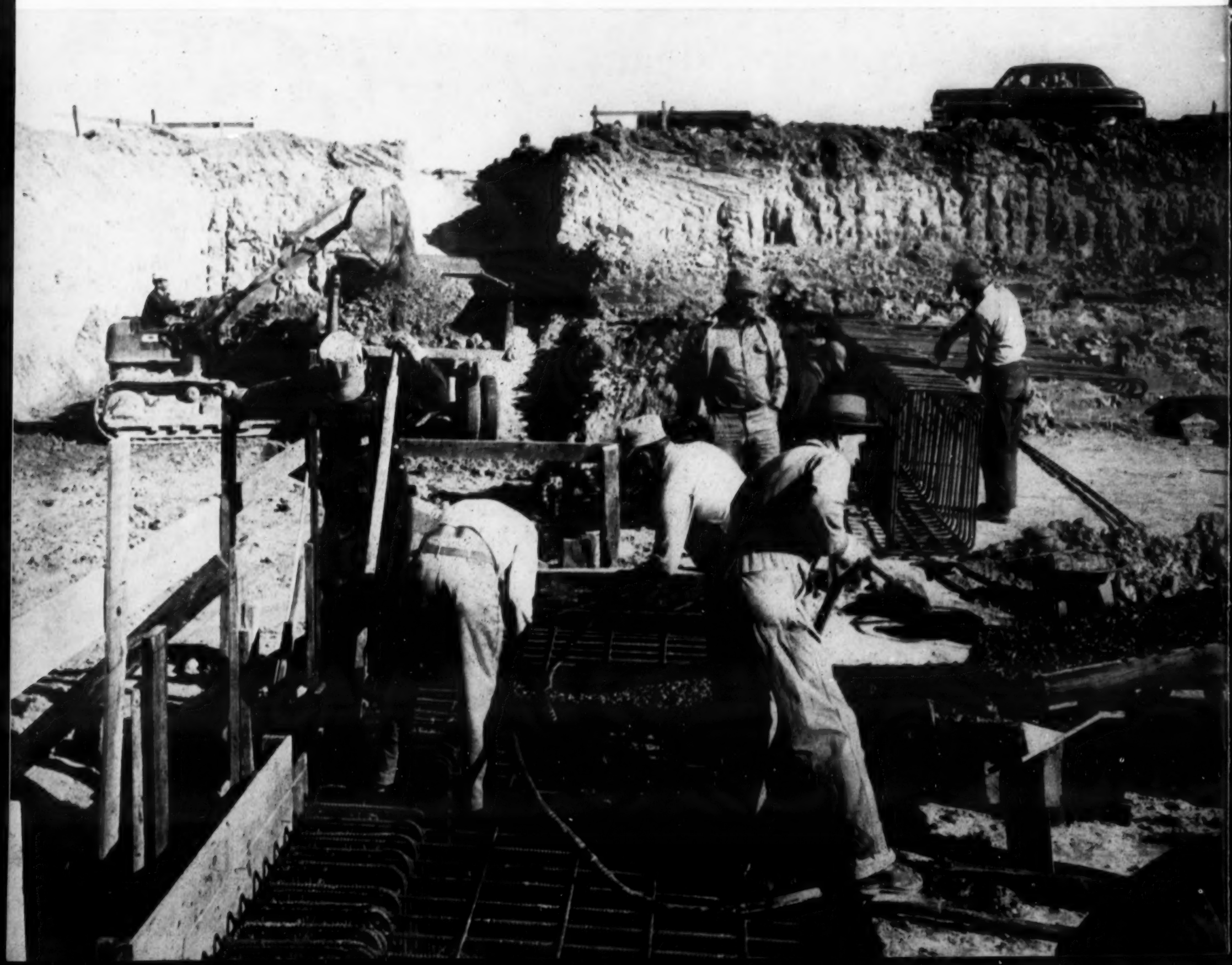


FIG. 3 CALCULATED SUMMER OPERATING CYCLE WITH 20-PSI PRIME MOVER ON NO. 2 AIR CONDITIONING UNIT

You can save yourself
many headaches and considerable money
in remedial measures if you know what is required for . . .

Sound diesel generator unit



foundations

D. NESTERENKO, Structural Engineer
R. T. POTTHOFF, Mechanical Engineer
Stanley Engineering Company

EQUIPMENT FOUNDATIONS are often given little attention until buildings and other adjacent facilities are designed and plans nearly completed. Sometimes the equipment foundation must fit into an opening left in the floor. Approximate foundation height is already established, having been set to accommodate general plant and building arrangement rather than correct foundation design. Also, because of over-all economy, the distance between pieces of major equipment often is insufficient to allow widening of the base where this would be desirable.

Many equipment foundations have been installed without proper consideration to the center of gravity for the complete equipment plus foundation. Designers seldom calculate whether the foundation will be in resonance with the forced frequencies of the equipment or indicate what shape should be used to prevent resonance.

Literature on this subject is limited. No exact computations of the vibrations to be dealt with are possible because of their complicated nature.

In general, equipment foundations can be grouped into one of two types:

- **Block (or box) foundations.** These are constructed as properly reinforced solid masses of concrete. Sometimes cavities or holes must be provided within the block to decrease its weight or shift the center of gravity. In such cases the foundation may look like a monolithically poured rigid box with intermediate walls. Diesel generating unit foundations are typical of this type.
- **Rigid frame foundations.** These usually include a lower portion, consisting of a thick reinforced concrete base slab, and an upper portion, consisting of a rigid reinforced concrete (sometimes steel) frame built on and supported by the base slab. Foundations for steam turbogenerator units, turboblower sets, and similar items that demand space under the main equipment for condensers, piping, and other equipment are typical of this type.

When considering the use of a block (or box) type foundation — the usual type for diesel generating units — to be placed directly on soil, different design features should be applied for diesel generating units within different speed ranges:

- **Range 1.** For machines *without* unbalanced secondary forces or couples, and with rotative speed of approximately 550 rpm or less; or for machines *with* unbalanced secondary forces or couples and with rotative speeds of approximately 275 to 300 rpm or less, the foundation should have a projected bottom slab and its weight per square foot of bearing area should be kept low. A box foundation may be a good solution.

Machines with a low rotative speed (in the approximate range 100 to 200 rpm) should have the usual block foundation designed to obtain a natural frequency higher than the rotative speed. Piling supports may be objectionable in this case unless battered piles or stiffer pile clusters could increase the natural frequency. Springs are not necessary for this speed range and may only cause poorer performance.

Machines with rotative speed ranging from 200 rpm to 550 rpm should have foundations supported on soil or on piling, whichever is necessary because of soil conditions. Some units with rotative speeds of 300 rpm or higher, and with unbalanced secondary couples or forces, may need springs to assure completely satisfactory performance.

- **Range 2.** For machines either with or without unbalanced secondary forces or couples, and with rotative speeds ranging from approximately 600 rpm to 1200 rpm, springs between two concrete foundation blocks should be used. Selection of springs, location, and number needed are based on design requirements, which vary for each case. Sometimes piling may be substituted for springs. Because springs transmit sound, a layer of felt or lead may be placed between foundation and springs. Use of rubber is objectionable because it deteriorates too quickly.

Spring selection is generally governed by the static load superimposed on the springs and by the desired deflections in vertical and horizontal directions. To secure the desired deflection, factors of allowable stress of spring material, number of coils, coil diameter, wire diameter, modulus of rigidity, and spring correction factor must be taken into account.

Springs are usually installed in mechanical units with several springs in one unit. These units must be located in positions that will result in equal loading for all spring units, assuming that spring units of equal characteristics are used. Spring units must rest on a thick reinforced concrete slab and allow convenient access for maintenance. They will support the upper part of the foundation together with the equipment.

- **Range 3.** For machines with rotative speeds above approximately 1200 rpm, foundation bearing area should not be too large and foundation weight per square foot of bearing area should be greater than for Range 1.

For foundations on piling, some modifications should be considered. In Range 1, a widened bottom slab is usually not required. In Range 2, springs may or may not be necessary. In Range 3, the greater foundation weight per square foot of bearing area may not be beneficial.

Design features for the three rotative speed ranges are based on approximate characteristics of most soils upon which the foundation may rest and on the usual ranges of equipment and foundation weights and dimensions.

Dynamic computations should be performed for all foundations to check necessary foundation dimensions and to avoid resonance. Exact computations of all vibrations are not possible because of the approximate nature of the empirical data that must be used. All computed values of natural frequencies should differ considerably, therefore, from forced frequencies (rotative speed, and also double the rotative speed in the case of secondary unbalanced forces and couples) by 20 to 50% or more, to provide a large safety margin.

consider basic formula

To help clarify this point, refer to the basic formula (1), which in its general fundamental form may be used to compute the frequency of vibration without damping action:

$$f = \frac{60}{2\pi}\sqrt{\frac{kg}{W}} \qquad (1)$$

$$\text{Assuming } d_s = \frac{W}{k}, \qquad (2)$$

$$\text{then } f = \frac{187.7}{\sqrt{d_s}} \qquad (3)$$

where W = weight in pounds
d_s = deflection under static load in inches
k = spring constant in pounds per inch
g = acceleration of gravity (386 in /sec^2)
f = frequency in vibrations per minute (vpm)

Instead of the modulus of elasticity E, and the modulus of rigidity G, in the case of soil, the so-called dynamic subgrade coefficients (values of C and S respectively), which represent the degree of yield, are used. For instance, $d = \frac{W}{C}$ in vertical

(continues on page 40)

Tunnel in foundation reduces loads on soil, changes frequency of mass, protects against resonance.

When irritating vapors from volatile solvents threatened shutdown of the Dandecal Division, Fremont, Ohio, Consolite Corp. engineers proved that . . . .

Activated carbon removes irritating vapors

S. C. LARKINS
Plant Manager
Consolite Corp.

WILLIAM L. DAVIS
Solvent Recovery Manager
Barneby-Cheney Co.

VAPORS FROM VOLATILE solvents, used in silk-screening process, were threatening shutdown of the Dandecal Division plant, Consolite Corp., Fremont, Ohio. Contaminated air caused acute discomfort to workers. Their eyes burned and tears flooded and obscured their vision. By 2:00 pm each working day, employees were virtually unable to work any longer.

Superintendent of operations, Raymond Zweily, and plant manager, S. C. Larkins, pooled their efforts to find a solution to this problem. They knew that unless something was done to alleviate lachrymous vapors from volatile solvents, a shutdown was inevitable. Strong solvent odors released from silk-screen inks also affected breathing and general comfort. Ventilation was the big headache in more ways than one.

Humidity and temperature variations seriously affect silk-screen process registration. Paper size and shape must remain constant. This is controlled by maintaining both humidity and temperature at constant levels.

air conditioning is a necessity

Since humidity and temperature control are vital, air conditioning becomes a must. Closed-in decalcomania areas, therefore, are subjected to odors of volatile solvents used in silk-screening. These odors continuously build up in concentration. Solvent vapors cannot be vented to the outside in volume because the resulting atmospheric pollution would create a community relations problem. Also, the cost of temperature and humidity control of replacement air would be high.

To solve the odor problem, the Solvent Recovery Division of the Barnebey-Cheney Co. was consulted. Consolite officials figured that a combined solvent-recovery and air-purification system, engineered to their specifications, might be the answer.

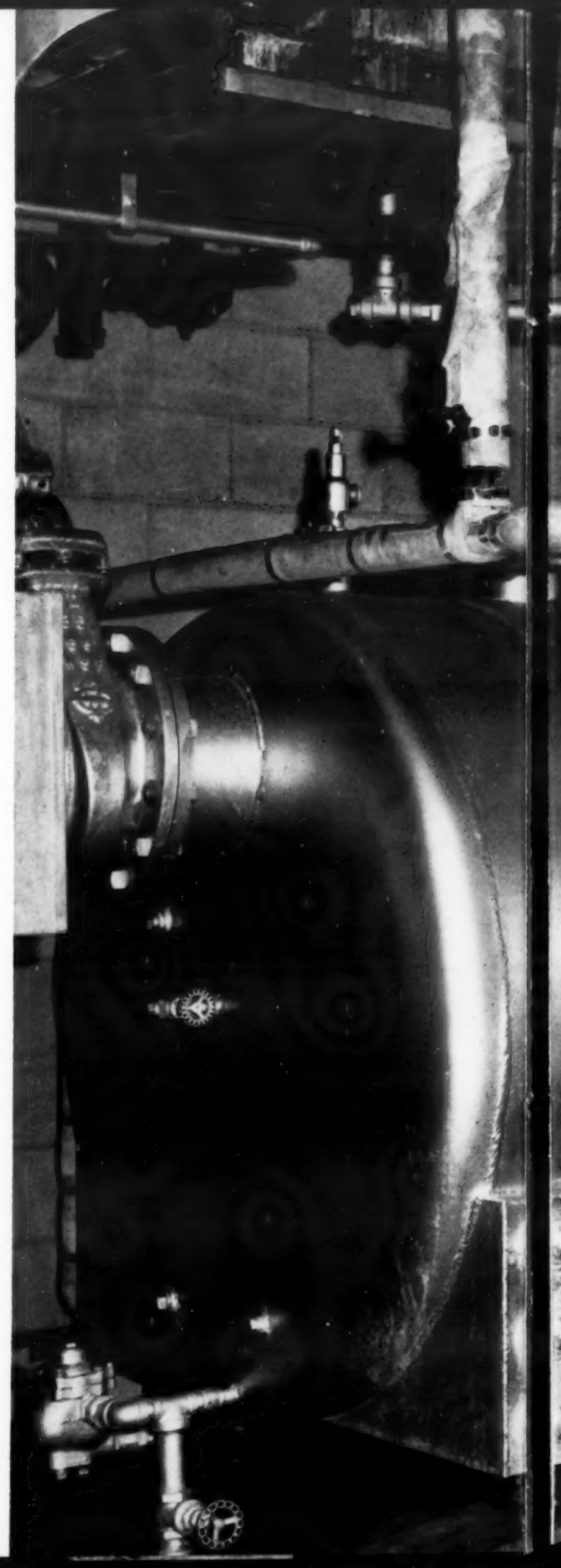
Activated carbon, sometimes known as activated charcoal, accomplishes important air-purification tasks by its power of adsorption. This property is due to its sub-microscopic structure, which consists of many tiny interconnecting capillary passages not much larger than the molecules that are adsorbed.

The large internal surface area of activated carbon attracts and holds many gases and liquids, removing them from the air stream. Barnebey-Cheney engineers devised an air-purification system for Consolite that brought immediate relief in solving the air pollution problem.

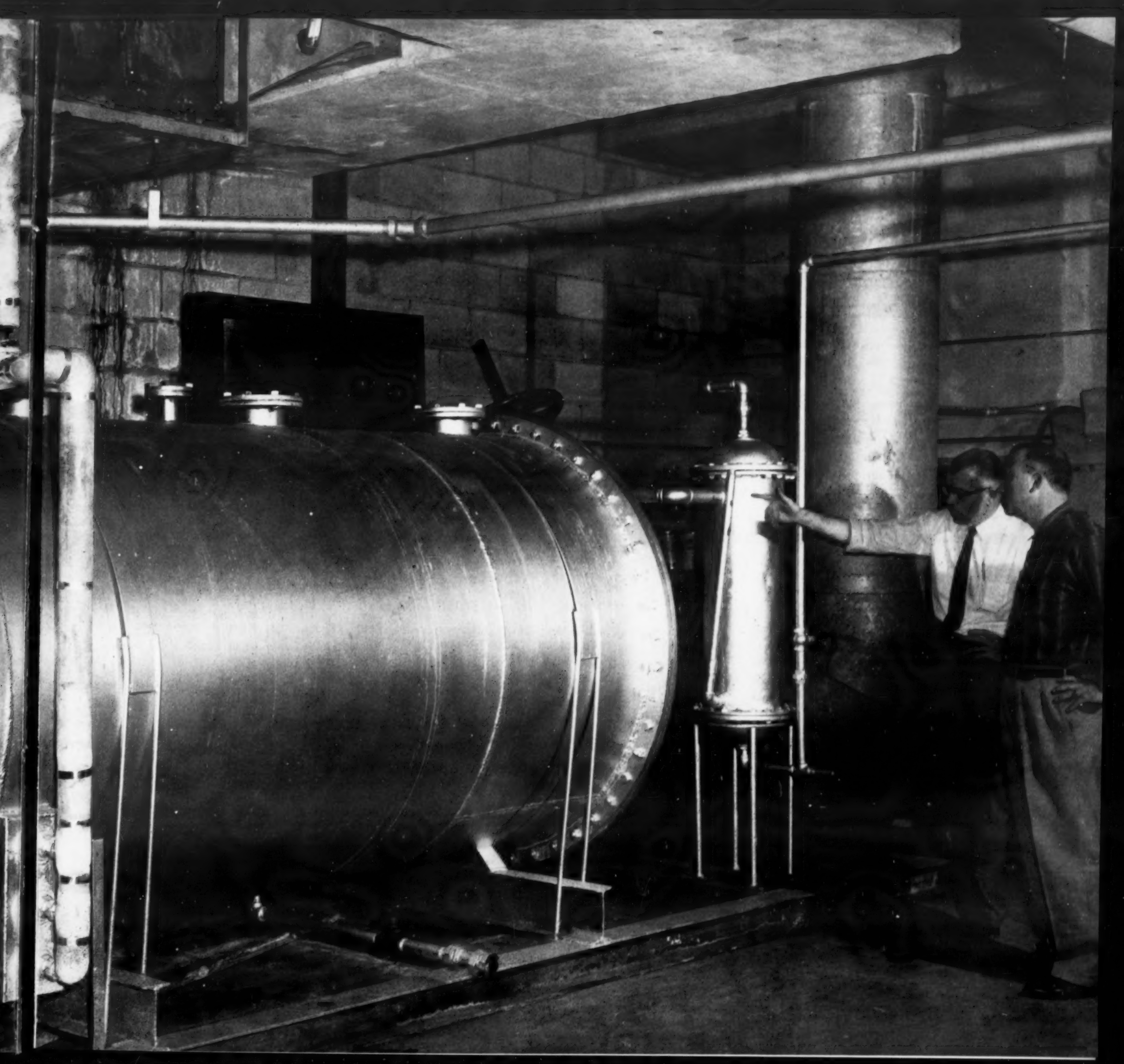
The system's nucleus is a bed of activated charcoal, made from coconut shells, placed within a horizontal, canister-type adsorber. Contaminated air from the air-conditioned decal room is drawn through this adsorber and through the carbon bed. Activated carbon strips the accumulated solvent vapors derived from gasoline, naphtha (treated with carbon tetrachloride), turpentine, lacquer thinners, synthetics, and other solvents used in the silk-screening paints.

Stripped air, relieved of the vapors, gases, and other odors, actually is pure and fresher than out-

(continues on page 44)



Activated carbon in canister is regenerated monthly by steam distillation using the plant steam supply.



POWER BASICS

FOR

TODAY'S INDUSTRY

Engineering Economics--IV

How to recognize and avoid BOOBY TRAPS

We all know that you can prove anything with figures. But, in trying to do an honest job of deciding which of several alternatives will cost least in the long run, many of us shy away from economic principles. This series has presented the simple facts in four chapters. As John Dryden said, "Errors, like straws, upon the surface flow; He who would search for pearls, must dive below."

EUGENE S. FERGUSON
Associate Professor of Mechanical Engineering
Iowa State College

with Donald Hartley, Managing Editor

AN ENGINEERING ECONOMIC study should be concerned first with dollar comparisons between alternative ways of doing a job that involves new or rearranged facilities. The objective of the study is to tell us which alternative has the lowest cost *in the long run.*

Fixed charges must be included in any valid engineering economic study. We have seen that failure to include these charges will inevitably distort the information that the study is designed to give. All too frequently, a wrong decision is made because the fixed charges are overlooked.

When these fixed charges, figured on a yearly basis, are added to annual variable costs — labor, supervision, fuel, supplies, maintenance, and so on — the resulting total can be compared directly with the total annual costs of another alternative. We have developed only the annual cost method of comparison in this series.

Items that cannot be reduced to dollars — intangibles — are brought into the study *after* dollar comparisons have been made.

Sinking fund depreciation has been used because it is based on the fundamental assumption that money should not lie idle, and that it can therefore be invested somewhere in your business to yield an attractive return.

where are we headed?

There are many snares that beset the unwary arranger of figures. Figures are slippery. Sometimes they tell half-truths; always they demand interpretation.

Because some snares in engineering economics are not self-evident, we will look at two of the more dangerous ones:

- Return on an additional investment (incremental return)
- Effect of income taxes on an economic study.

First, let us look at an example of a simple engineering economic study. Then we will see why the factors just mentioned must be considered before reaching a final decision.

Example 1: A chemical plant expects to install a new process unit that will require 15,000 lb/hr steam for heating. An additional 450 kw electric power will be necessary. The unit is expected to be in operation for 80% of each year (about 7000 hours). Two alternatives will be considered:

- Steam can be generated for heating alone, and electricity can be purchased for 1.2¢/kwh, including demand charges
- Steam can be generated at higher pressure and temperature. An extraction turbine can take high pressure steam at the throttle and heating steam can be obtained from the extraction opening.

An interest rate of 8% on any investment in new power plant equipment has been selected by management. Not because it costs 8% to borrow money, but because any money invested in the process unit itself is expected to earn an 8% return. In other words, any additional expenditure for an extraction turbine should earn as high a return as money spent for the process unit. Management feels that an investment in such new

equipment should be paid off (amortized) in 15 years.

The estimated annual costs of alternatives A and B are:

	ALTERNATIVES	
	BUY ELECTRICITY	MAKE ELECTRICITY
	A	B
Additional first cost of higher pressure and temperature boiler		$10,000
First cost of turbine, installed		50,000
First cost of transformer, required if power is purchased	$10,000	
Contingencies (10%)	1,000	6,000
	$11,000	$66,000
Additional first cost of alternative	0	55,000
Fixed charges:		
Interest (8%)		4,400
Depreciation (sinking fund—3.7%)		2,035
Taxes (4%)		2,200
Insurance (1%)		550
Total fixed charges	0	9,185
Operating costs:		
Turbine operators		20,000
Turbine maintenance		2,000
Additional fuel required for turbine operation (2 mills/kwh)		6,300
Cost of purchased power (7000) (450) (0.0012)	37,800	
Total operating costs	37,800	28,300
TOTAL ANNUAL COST	$37,800	$37,485

Common sense tells us that this difference (less than $400) between the two sets of estimated figures may not be significant. Perhaps the intangibles will decide for us. We may not want to get into the generating business at all. We may decide that the power company's service would be more dependable, because we have provided for no reserve in case of an outage of our generating facilities. Alternatively, we may want to protect ourselves against increases in rates by the power company.

But suppose the fixed charges had been omitted from these figures. The annual operating costs of B ($28,300) when compared with purchased power costs ($37,800) would make alternative B very attractive. It would be easy to reach an erroneous conclusion.

what is return on additional investment?

Considering this same example another way, we may look at the comparison and conclude that the additional investment of $55,000 will save only $315 per year — a negligible return. This is not so, however. Fixed charges enter the picture again.

Savings to be realized by the investment of $55,000 are:

Operating costs, alternative A	$37,800
minus	
Operating costs, alternative B	28,300
Annual saving	$ 9500

Thus, $9500 will be available each year to pay the fixed charges of $9185. This is more than sufficient to cover the fixed charges that will earn an 8% return on the investment. Eliminating the intangibles and assuming that all our figures are accurate, the investment would be attractive.

Example 2: In this example, the return on an additional investment is attractive in one case but not in another. The figures have been reduced to a bare minimum in order to fix the principle involved (that *any additional* investment should earn a satisfactory return).

Suppose that there are three alternative ways of satisfying a need. Alternative A requires no investment, but will have annual operating costs of $1000. With alternative B, a $1000 investment will permit us to reduce annual operating costs to $700. With alternative C, a $3000 investment will further reduce annual operating costs to $480.

	ALTERNATIVES		
	A	B	C
Investment required	0	$1000	$3000
Annual operating costs	$1000	700	480

Consider A and B. For an additional investment of $1,000, an annual saving of $300 will be realized. The return on the investment, therefore, is $\frac{300}{1000} = 30\%$. This saving is available to pay fixed charges on the investment. Using the fixed charge rate calculated in Example 1 ($\frac{9185}{55,000} = 16.7\%$), it is evident that a 30% return on the additional investment will more than pay the fixed charges. The investment is an attractive one.

Now compare A and C. For an additional investment of $3000, an annual saving of $520 will be realized. Return on the investment is $\frac{520}{3000} = 17.3\%$. This still exceeds the 16.7% fixed charge rate. But wait!

If we compare B and C, we find that an additional investment of $2000 will result in an annual saving of only (700 − 480 =) $220. Return on this additional investment, then, is only $\frac{220}{2000} = 11\%$, which is not sufficient to pay the 16.7% fixed charge rate.

Thus, B is the most attractive alternative of the three.

This principle, that *any additional* investment should earn a satisfactory return, should be constantly kept in mind when three or more alternative solutions are being considered.

effect of income taxes

Because there are many aspects to the income tax problem, we won't attempt to cover the field here. But to emphasize the need for considering income taxes before reaching a final decision, here is a brief look at the nature of the problem.

With income tax rates in the order of 50% of net income — the well-known "income before taxes" — it is to management's advantage to claim all legal deductions, just as we all do each year on Form 1040.

Depreciation is one of the deductions. The larger

(continues on page 46)

CHECK LIST FOR AN ENGINEERING ECONOMIC STUDY

For each alternative plan, the annual costs will be the sum of:

1. ***Fixed charges***
   - ***Interest on any new investment***
   - ***Depreciation***
   - ***Interest***
   - ***Taxes***
2. ***Operating Costs***
   - ***Labor and supervision***
   - ***Fuel, lube, and water***
   - ***Supplies***
3. ***Maintenance***
   - ***Labor and supervision***
   - ***Materials, tools, supplies***
   - ***Maintenance work by outside contractors***
4. ***Any other costs that are not the same for all the other alternative plans.***
5. ***Contingencies. Usually 5 to 20% of the sum of items (1) through (4), depending upon accuracy of the figures that have been assembled.***

Have you checked to make sure that any additional investment will yield a return that is large enough to make it attractive?

Have you checked the effect of income taxes on each alternative plan?

Today's high-capacity electric motors demand reduced-voltage starting for better performance, safer operation, and reduced operating cost. Westinghouse Electric Corp. expert explains . . . .

How to apply reduced-voltage starters

J. C. MAROUS
Consulting and Application Engineer
Westinghouse Electric Corporation

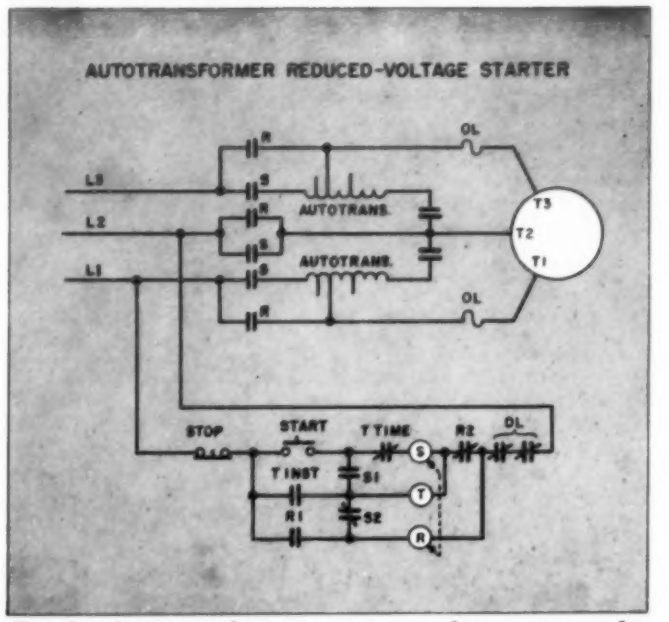


Fig. 2—Autotransformer starters reduce motor voltage, allow more torque per amp than resistance type.

EACH OF FOUR reduced-voltage starting methods (resistance, reactor, autotransformer, and increment or part-winding) avoids the serious problems of current inrush or starting torque for present-day, three-phase motors.

Today's high-capacity air-conditioning installations afford an excellent example. Typical compressor motors are frequently above 50 hp and are started and stopped often. If a large motor like this is started across the line, a noticeable voltage dip will occur.

Consider the characteristics of a conventional three-phase motor during starting. These characteristics must be controlled to meet the current inrush or the starting torque requirements.

We can determine the motor torque and current of a particular motor (10 hp, in this case) at any speed as long as the motor is connected to a 220-volt supply. The design full-load current for this motor is 27 amps. If the motor is started across the line, the inrush current at zero speed is 170 amps and the starting torque is 78 lb-ft. Inrush current is in the order of six times full-load current.

what is reduced-voltage starting?

Reduced-voltage starting with a resistance starter is obtained simply by inserting resistance in series with the motor (Fig. 1). At starting, a voltage drop is created across the resistor. This reduces voltage applied at motor terminals and in turn reduces motor inrush current and starting torque. If voltage at motor terminals is reduced to 75% of full value, starting current is reduced to 75% of normal locked-rotor current. Starting torque is reduced to $(0.75)^2$ or 56% of its original value.

Reactor-type, reduced-voltage starters are similar to resistance starters except that a series reactor is used rather than a series resistor. Inrush current and torque varies in the same manner as for the resistance starter.

Autotransformer starters reduce motor terminal voltage (Fig. 2). Since both motor torque and line current are proportional to the square of the reduced voltage, maximum torque per ampere is possible. If motor terminal voltage is reduced to 75% of its value, both line inrush current and motor torque will be reduced to $(0.75)^2$ or 56% of original value. This is more torque per ampere than is obtained with the resistance starter.

In part-winding starting, only a portion of the total motor winding is initially connected to the line in order to obtain a reduction in current and torque (Fig. 3). For this type, starting torque is reduced to approximately 50% of its full-winding starting value. Current is reduced to approximately 65% of its full-winding, locked-rotor current.

Frequently, a reduced-voltage starter is applied to limit the inrush current. After the drive is installed, it is found that peak starting current sometimes exceeds the calculated value. In many instances, this occurs because the transfer current is neglected. Transfer current is that current peak which occurs when the motor is transferred from reduced voltage to full voltage.

To reduce transfer current as much as possible,

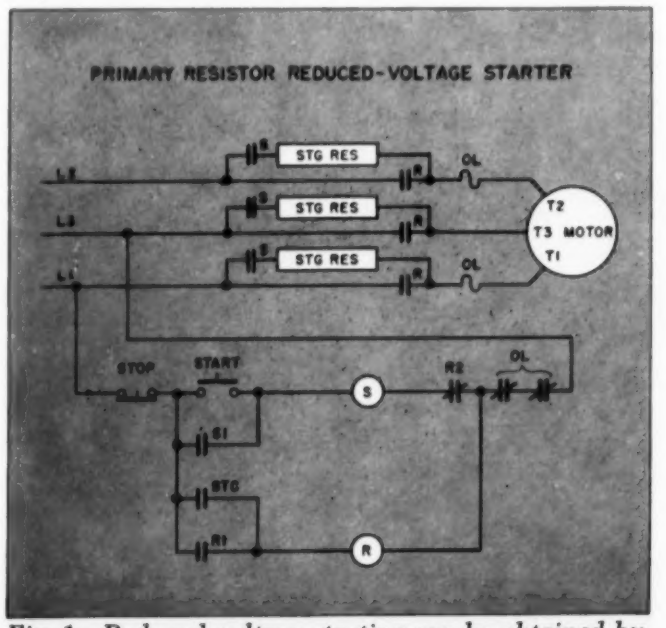


Fig. 1—Reduced-voltage starting can be obtained by simply inserting resistance in series with motor.

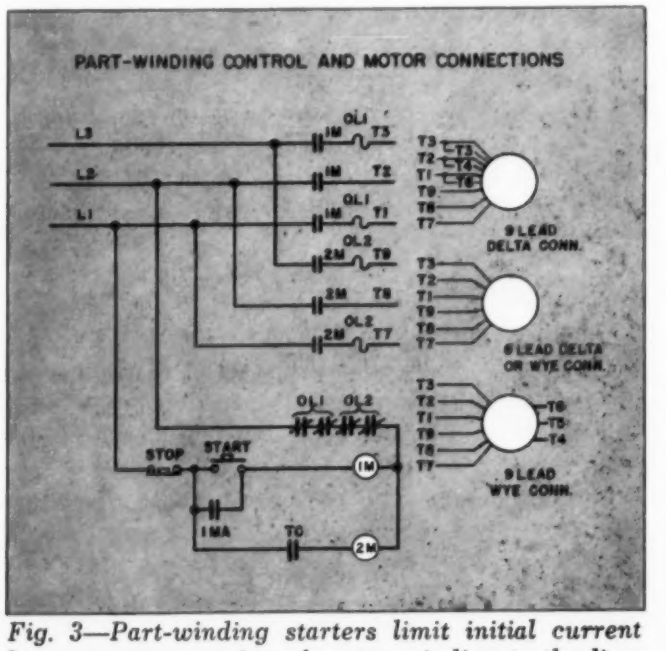


Fig. 3—Part-winding starters limit initial current by connecting portion of motor winding to the line.

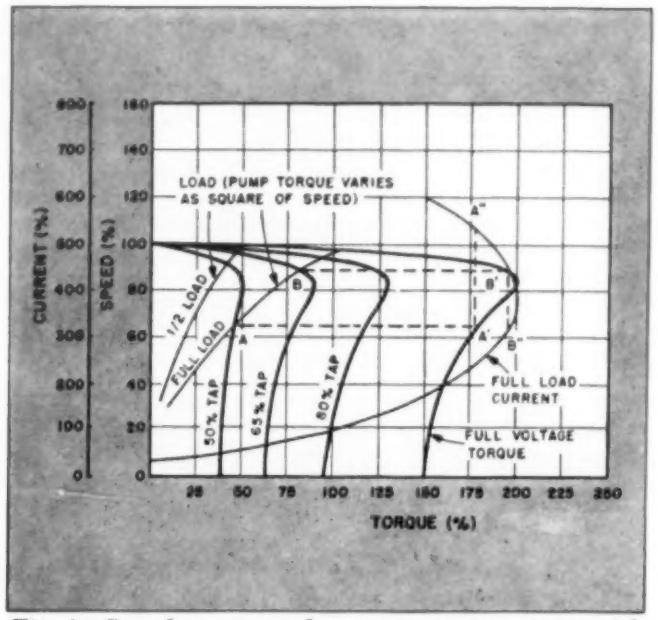


Fig. 4—Speed-torque and torque-current curves with tap variations for a typical squirrel-cage motor.

it is desirable to leave the motor connected to the reduced-voltage tap until the load is accelerated to its maximum speed. If it is not possible to accelerate the load to a satisfactory speed, it may be better to use a higher voltage tap for starting. Although this will increase starting current, it will provide more torque to accelerate the load to a higher speed and thereby reduce the transfer current. When transferring from one tap to another, transfer at a point when the starting current on the reduced-voltage tap is as equal as possible to the transfer current on full voltage.

For example: A squirrel-cage motor drives a large centrifugal pump. The motor has a starting torque of 150% and a locked current of 600% of full-load values. The problem is to determine which autotransformer tap will give the best overall performance considering current at starting and at transfer to line voltage.

If the 50% tap is used when the pump is fully loaded, starting current will be equal to $(0.50)^2$ (600%) or 150%. Load will then be accelerated to a maximum speed at point A (Fig. 5). Load cannot be accelerated beyond this point since there is no accelerating torque available to do so. If transfer to full voltage is made at this point, the transfer current will be 540% of full locked-rotor current as shown at point A. Similar values determined for various other conditions are tabulated below.

Voltage Tap	Starting Current	Transfer at Full Load	Current at 50% Full Load	Starting Torque
50%	150%	540%	240%	37.5%
65	252	310	140	63.0
80	384	220	210	96.0

For the full load condition, the 65% tap is most suitable since starting current and transfer current are more nearly equal than for other positions. Similarly, for the half-load condition, the 50% tap would be most suitable.

what factors control starter selection?

Problem 1: Select a starter for a 5-hp, 3/60/220/1750 motor to satisfy the following conditions—

- No inrush restrictions
- Load may be accelerated quickly
- Gentle start not required.

Solution: Across-the-line starter should be used because it is the simplest and cheapest starter available. It will satisfy these requirements.

Problem 2: Select a starter for a motor with the following requirements—

- 10-hp NEMA Design B motor 3/60/220/1750 having a full-load torque of 30 lb-ft, a starting torque of 175% or 52.5 lb-ft, full-load current of 26.8 amps, locked-rotor current of 150 amps
- Gentle start not required
- Power company limits the inrush to 125 amps
- Load starting torque is 20 lb-ft.

Solution: Let us consider a resistance-type starter. If a reduced-voltage of 75% of full line voltage is applied with a resistance-type starter, available starting torque will be 29.5 lb-ft and inrush current will be 112 amps. Since this meets the above torque and current requirements, this type of starter can be used. In addition, it will provide a cushion start and closed transition starting.

A part-winding motor and starter can be used also, since maximum transfer current would be 80% of locked-rotor current or 120 amps. It would be an economical system. Resistance-type starter is preferred if a standard motor is already available and only a starter is to be purchased.

Problem 3: Select a starter for an application identical to Problem 2 except that the inrush current is limited to 105 amps at all times during the starting period and starting torque load is to be 22 lb-ft.

Solution: To use a resistance starter, voltage must be reduced to 70% of full voltage to meet inrush requirements. With reduced voltage of 70%, however, starting torque is reduced to 25.73 lb-ft. With a starting torque load of 22 lb-ft there is insufficient accelerating torque available. With an autotransformer using an 80% tap, inrush current is limited to 102 amps (including transformer magnetizing current) and provides a starting torque of 33.5 lb-ft. This scheme is satisfactory and an autotransformer starter should be used for this application.

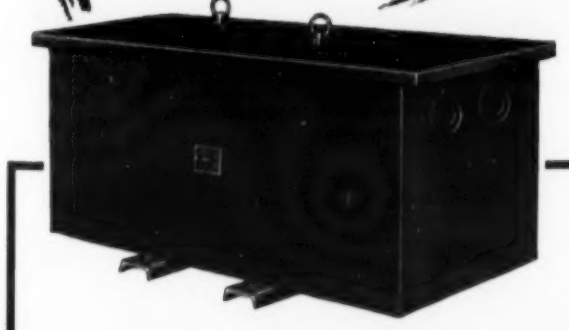
A part-winding motor can be considered for this application. Unless a special winding is employed, however, transfer current of 80% will exceed the maximum 105 amp requirement.

Problem 4: Select a starter for the motor given in Problem 2 except that starting torque load is to be 30 lb-ft. Also, a smooth start is required and in-

(continues on page 48)

3Ø DRY TYPE CLASS H INSULATED TRANSFORMERS

SHIPPED PROMPTLY FROM Acme Electric



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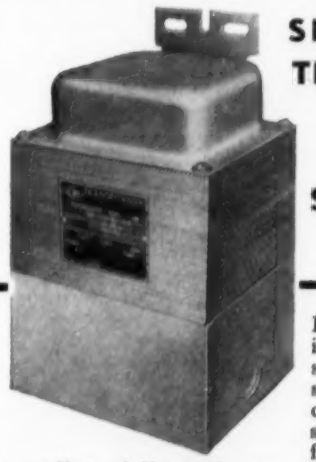

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401-Union and valve catalog

Catalog 56 gives data on Catawissa hot forged steel unions and valves for most industrial applications. Includes engineering specifications, installation data. Twenty-four pages. CATAWISSA VALVE AND FITTINGS CO.

402-Catalog gives fan data

Bulletin A-111B covers adjustable-pitch cooling-tower and heat-exchanger fans. Gives specifications and performance data on aluminum-alloy blade fans from 40 to 132 in. dia and plastic blade fans from 10 to 22 ft dia. Eight pages. HARTZELL PROPELLER FAN CO.

403-Automatic controls for cooling towers

Bulletin B-1050 describes newly patented system that automatically controls makeup water flow, chemical feed, blowdown rate of cooling towers. Conserves water and chemicals, reduces manpower, lowers maintenance costs by maintaining correct water level in cooling tower basin. Keeps correct concentration of dissolved solids, controls chemical feed to makeup water. Four pages. BAILEY METER CO.

404-How to estimate draft creator capacity

Tables in Bulletin QF-SD help you determine capacity of standard Quickdraft units for most applications. Include capactities in gph (oil), cu ft/hr (gas), and lb/hr (coal). Charts and diagrams give useful installation data. Eight pages. QUICKDRAFT CO.

405-General boiler catalog

Weil-McLain boiler line is described in Catalog H-211. Includes ratings, data, and dimensions on gas-, oil-, and coal-fired boilers, oil heating units, hot-water supply boilers, and indirect water heaters. Fully indexed. Fifty-two pages. WEIL-MCLAIN CO.

406-Water, waste treatment manual

Infilco line of water and waste treatment equipment is described in Bulletin 80 titled "Products and Processes." Contains handy cross reference to other bulletins detailing specific equipment in municipal, industrial, sewage, and industrial waste treatment fields. Thirty-two pages. INFILCO, INC.

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Bulletin W-5 gives parts lists, dimensions, shipping weights for G-A cushioned float valves for water level control in tanks, reservoirs, coagulating basins, etc. Available for either hot or cold water in quick-opening or throttling design. Sixteen pages. GOLDEN-ANDERSON VALVE SPECIALTY CO.

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Catalog C-5000 discusses Rockwell meters, regulators, and valves. Describes new Rockwell telapilot with power pilot loading by remote control and Hypregun, air-operating valve lubricant gun. Includes Nordstrom valve specifications. Twenty-eight pages. ROCKWELL MANUFACTURING CO.

410-Transformer buyer's guide

Bulletin GEC-1028B gives price and product data on General Electric's instrument transformer line. Includes prices, ratings, ASA accuracy classifications, weights and dimensions on current and potential transformers, metering outfits, Thyrite protectors. Ninety pages. GENERAL ELECTRIC CO.

411-Solve ventilating problems

Bulletin PL-801 describes new Power Line ventilating fans, including dome roof and wall ventilators, penthouse units, centrifugal ventilators and utility blowers, air blasters and man coolers. Lists panel and tubaxial exhaust fans. Installation and performance data included. Twenty pages. POWER LINE FAN CO., DIV. OF CHELSEA FAN & BLOWER CO., INC.

412-Mechanical seal data guide

Dura Seal rotary mechanical shaft seal for processing equipment resists corrosive fluids, operates even with gritty or abrasive fluids. Bulletin 480 describes different types, gives recommended uses for each. Sixteen pages. DURAMETALLIC CORP.

413-Engineering specs on deaerators

Bulletin 102-A gives capacities and dimensions of 30 models of 10-minute and 2-minute storage time deaerators, with engineering drawings of typical layouts. Drawings trace path of water from entrance to storage in deaerator tank. Eight pages. L*A WATER SOFTENER CO.

414-Power plant fire protection chart

Useful wall chart rates water spray, mechanical foam, CO_2, and dry chemical fire-protection systems for effectiveness with such hazards as fuel supply and storage, turbine basements, transformers and oil-filled electrical equipment. Bulletin 76 includes installation photographs showing sprinkler systems designed to protect power plant operation. Twelve pages. AUTOMATIC SPRINKLER CORP. OF AMERICA.

new Misericordia Hospital will

SAVE THREE WAYS*

BY INSTALLING

FW PACKAGED STEAM GENERATORS

Lowering one of the 43,500 lb FW Packaged Steam Generators into the basement of the Misericordia Hospital.

SCHEDULED for completion early in 1958, the $8,000,000, 210-bed Misericordia Hospital, Bronx, N.Y., will be fully equipped with the finest and most modern facilities obtainable.

All steam requirements will be supplied by three fully-automatic Foster Wheeler Packaged Steam Generators, each rated 17,500 lb/hr at an operating pressure of 125 psi. Each two-pass steam generator contains 1857 sq ft of heating surface and generous furnace volume. Staggered tube arrangement permits a high heat transfer rate and low exit gas temperatures.

FW Packaged Steam Generators are available in capacities from 10,000 to 60,000 lb/hr and pressures to 1300 psi. For complete information, send for Bulletin No. PG-55-3. *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

* **SAVE TIME** — because they were completely shop fabricated and delivered by truck direct to the building site, all ready to set in place and connect to power, fuel and steam lines.

* **SAVE SPACE** — because of exceptionally low ratio of unit size to quantity of steam produced. Measuring only 12'1½" high, 10'11½" wide and 16½' long, these 17,500 lb/hr units are installed on small, low-cost foundations.

* **SAVE MAINTENANCE** — because they are specially designed for easy servicing and inspection. Consisting almost entirely of water heating and steam producing pressure parts, there is a minimum of refractory and tile maintenance.

FOSTER WHEELER

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Circle 130 on READ-N-CIRCLE card for more data

415-Fluorescent lighting guide

FL-578 describes fluorescent lamp types, starters, lampholders, ballasts, special lamps. Includes useful ordering and installation data. Twenty-four pages. SYLVANIA ELECTRIC PRODUCTS INC.

416-Coolers for generator windings

Bulletin 1200 describes G-R K-fin coolers for air and hydrogen circulated through generator windings in a closed system. Also covers coolers for air and gas cooling or heating. Drawings and photographs give installation details. Twelve pages. THE GRISCOM-RUSSELL CO.

417-Retractable sootblowers to 38 feet

Bulletin 1030 describes Vulcan T-30 retractable sootblowers in lengths to 38 feet. Cross section drawings give details of moving parts and actuating components. Six pages. COPES-VULCAN DIV., BLAW-KNOX CO.

418-Boilers for 3400 to 33,000 lb/hr

Keeler CPM steam generator comes completely assembled. Fires gas or oil. Bulletin M-3A gives standard dimensions and capacities, typical performance figures. Sixteen pages. E. KEELER CO.

419-Manual on speed reducers to 140 hp

Bulletin 1105 describes concentric shaft and right-angle speed reducers for applications to 140 hp (up to 72,000 lb-in. output torque). Useful data includes horsepower and torque ratings, dimensions, overhung load and thrust capacities, application pictures. Reducers available in ratios between 1.49:1 and 1459:1. Twenty-four pages. THE FALK CORP.

420-Pocket battery buying guide

Reference Booklet GB-1788 aids in selecting proper battery, gives tips on achieving maximum battery life. Reviews importance of systematic maintenance. Sixteen pages. GOULD-NATIONAL BATTERIES, INC.

421-Brake horsepower rating chart

Handy wall chart in Bulletin CR 522-G shows brake horsepower of engines without fan or accessories and of power units with fan and accessories. Also rates all fuels for carbureted units. Horsepower ratings are corrected to standard conditions at sea level and 60 F. Four pages. INTERNATIONAL HARVESTER CO.

422-Pressure-time fuel metering for diesels

Bulletin 950138 describes Cummins PT fuel system that uses fixed-size injector opening with variable pressure controlled by the throttle to meter fuel charge to cylinders. Includes cutaways of fuel pump assemblies and injectors. Twelve pages. CUMMINS ENGINE CO., INC.

423-Bushed roller chain manual

Book 2454 gives complete mechanical specifications of LKS bushed roller chains in straight or offset sidebars with small or large rollers for power transmission and conveyor applications. Both types operate on standard wheels. Sixteen pages. LINK-BELT CO.

424-How magnetic repulsion switch works

Bulletin L-123 describes magnetic switching pump control for low water cutoff and alarm. Available for installations to 250 psi. Cross section drawings show magnetic repulsion switch details. Eight pages. MCDONNELL & MILLER, INC. ♦ ♦

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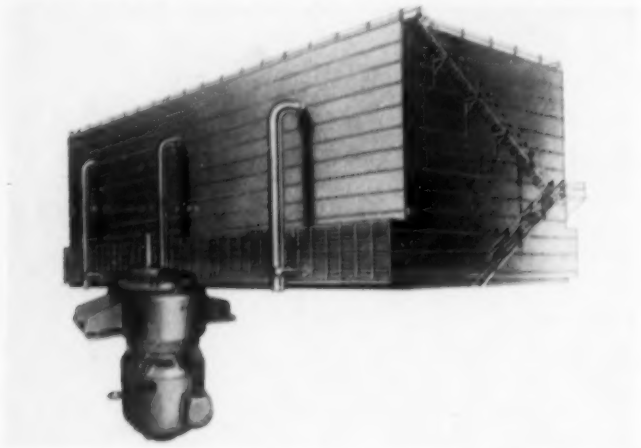
new products

. . . just circle key numbers on READ-N-CIRCLE card on pages 29 or 30

700-Cooling tower has five-year warranty

Entire cooling tower is built of non-leaching Cheminited Douglas fir. Straddle bracing construction utilizes



33% advantage in modulus of elasticity Douglas Fir maintains over conventional redwood structures. Vertical gearmotor design, developed especially for cooling tower service, eliminates right-angle gear units, shafts, and flexible couplings. Stainless steel hardware is used throughout for greater corrosion resistance. GALLOWAY CO., COOLING TOWER DIVISION.

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Repair broken factory floors without the usual traffic tie-up. Simply shovel INSTANT-USE into hole or rut—tamp smooth—truck over! No waiting! INSTANT-USE bonds tight to old concrete—right up to a feather edge. It's tough. Wears like iron. Won't crack or crumble. Install complete overlay where floors are badly chewed up. Used indoors or out. Immediate shipment.

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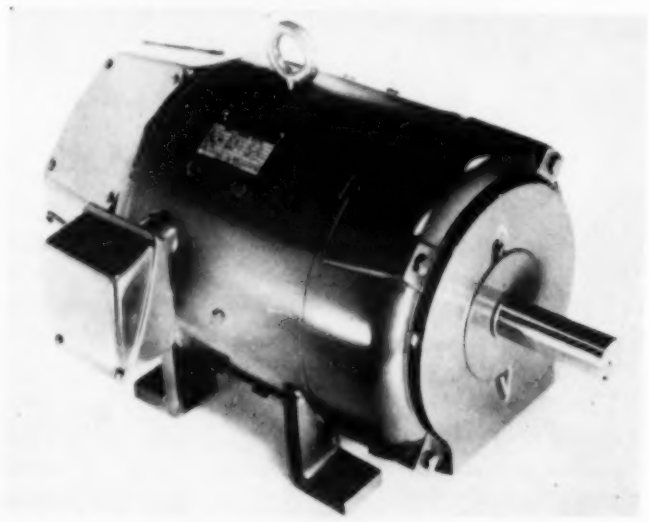
701-Records level at operating pressures

Compensating level recorder makes automatic compensation of boiler drum level measurements over operating range. Bourdon helix compensator continuously readjusts pen to record true drum level. Operating from drum pressure, compensator offsets effect of any change in specific weight of water. At saturation conditions, complete compensation is achieved over entire ranges of level, pressure, and temperature. Recorder is used on boilers with rated pressure above 900 psig, reheat boilers that must perform many hours below operating pressures during start-up. Level measurement ranges are from 0 to 12 in. to 0 to 70 in. water at maximum service pressure of 3500 psig. Pressure compensator range is 0 to 2500 psig. BAILEY METER COMPANY.

702-Attain reliability, dynamic response

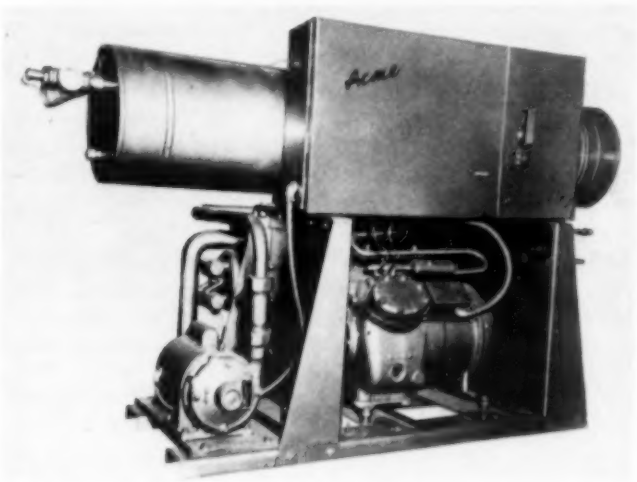
Dc industrial motors and generators depart from traditional designs to achieve new performance and dependability. Can be used equally effective as basic prime movers or as elements of highly complex automatic production systems. Progressive design features



high-temperature silicone insulation and controlled ventilation system that draws air from drive end, distributing flow throughout machine. Marked decrease in armature inertia and improved commutating ability gives motors fastest dynamic response now available. New motors have dripproof enclosures as standard, bear NEMA Class B ratings. Motor ratings span from 1 to 150 hp. WESTINGHOUSE ELECTRIC CORP.

703-Keeps out unauthorized personnel

Package liquid chiller has compact, tamperproof control cabinet to keep unauthorized personnel from making adjustments, thus avoiding possible break-downs. Ad-



vance design, V-type compressor is statically, dynamically balanced to minimize vibration. Each unit is factory-charged with refrigerant, shipped complete with piping and wiring. ACME INDUSTRIES, INC.

704-Changes fixed-speed motor speed

Power unit connected to 3-phase fixed-speed ac motor enables it to be changed to variable-speed without removing motor from present installation. By connecting induction motor leads to power unit, ac motor will receive variable frequency current. Speeds are changed at power unit by handwheel, or remotely by mechanical or electrical remote controls. Unit employs 3-phase circuitry throughout. U.S. ELECTRICAL MOTORS, INC.

705-Handles flammable liquids safely

Self-contained portable sump pump has bronze body, impeller, and strainer to resist corrosion and insure spark-free operation. Chemical solutions, flammable or explosive liquids can be handled safely. Pump has wide application in removal of sewage, sludge, chemicals, oil, or clean or dirty water from sumps. Heavy-duty thrust and radial bearings support two-part, nonclogging impeller mounted on stainless steel shaft. Bearings are double sealed. Pump speeds vary between 3200 and 3600 rpm, depending on discharge head and supplied air pressure. Excessive speed is prevented by built-in governor. SCHRAMM, INC.

(more new products on page 31)

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about our willingness to send you INDUSTRY POWER without demand of a token subscription fee? Nothing, really. You see, no publisher of industrial magazines breaks even on subscription revenue . . . . not after he's paid out the costs of getting that revenue. (Why, then, are there any "paid" magazines? Because the "paid" designation permits mailing at cheaper, second-class rates than is possible for "controlled-circulation" magazines, such as INDUSTRY POWER.)

We prefer to hand-pick the men who will receive INDUSTRY POWER (see qualification form on the reverse side of this card) on the basis of continuing research that tells us who are the important men that work in the field our editors and advertisers serve. By selective hand-picking, rather than by extracting a token fee from anyone who might be susceptible to a subscription pitch, we can be sure that we reach the men who matter most in managing the Power Services. Is that so strange?

The Editors

P.S. Many "paid" magazines have substantial "controlled" circulation . . . . up to 30 percent is permitted by postal regulation. And many publishers of "paid" magazines have "controlled" magazines in their stable, too. That IS strange.

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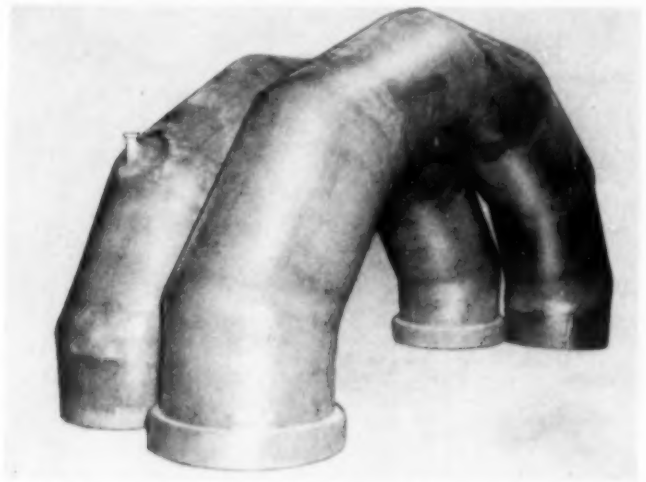
new products

. . . starts on page 26

706-Molded fume ducts are one-piece

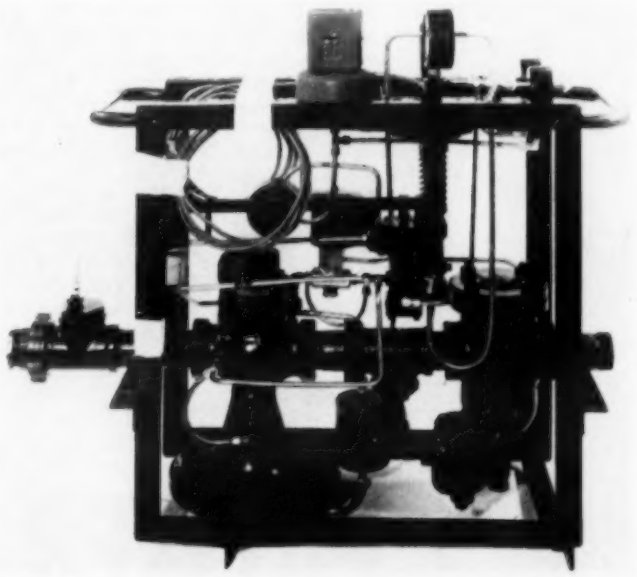
Corrosion-resistant polyester glass fume ducts are molded into a single piece. Glass-smooth inside and out, ducts provide high resistance to corrosion from



acids, hypochloride salts, weak alkalies and many organic solvents. Made in standard sizes to 24 in., in rectangular and circular forms. HAVEG INDUSTRIES, INC.

707-Valves make chiller control possible

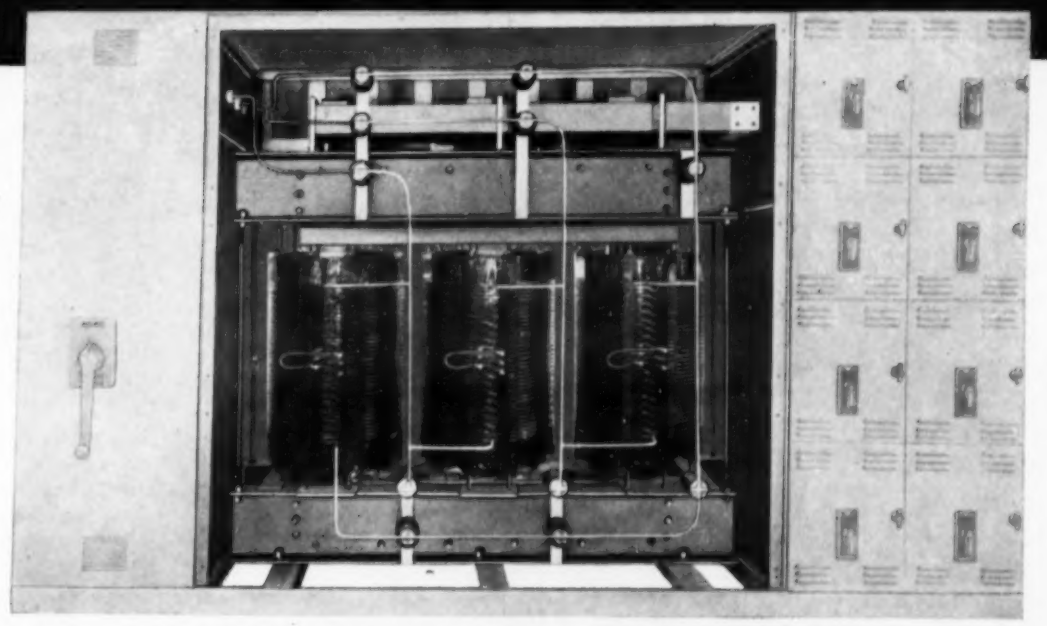
Heart of complete, self-contained control unit for 25-ton water chiller is regulating valve with four control pilots to provide throttling action. Valve admits steam at rates from 50% to 100% of chiller capacity as well as to provide off-on control. Steam to operate



chiller is taken from any source at 6 to 15 psig. Amount of steam admitted determines cooling effect. Proper regulation of steam under three conditions is vital to efficient operation. Three pilot valves are connected in series and any one of the three, by closing, can close main supply valve. SPENCE ENGINEERING CO., INC.

(more new products on page 32)

THE
transformer is the heart
OF A SUBSTATION



1000 Kva 13,200 volt Sorgel dry-type transformer in a substation—Compartment panel removed

A substation is no better than its transformer; therefore, it is important that the transformer is the best quality and dependable — a SORGEL transformer.

Quiet operation. The sound level of SORGEL dry-type transformers is well below the established standards. Adaptable for any indoor installation, especially where sound level is an important factor.

Liberal design. High efficiency at all loads, with a liberal overload capacity at a safe operating temperature.

Rugged, substantial construction. Vacuum-impregnated windings brazed to terminals. Bolted connections are silver plated. Extra insulation on end coils to withstand voltage surges. Disc type coils for the higher voltages.

SORGEL transformers are time-tested, and are recognized and accepted by discriminating engineers and users everywhere.

Sizes 100 Kva to 3000 Kva, and all voltages up to 15,000 volts, either dry-type or Askarel-cooled, are procurable with any make or type of switchgear, and from any substation manufacturer.

Specify SORGEL transformers For better substation performance

Sales Engineers in Principal Cities

SORGEL TRANSFORMERS

SORGEL ELECTRIC CO., 841 West National Ave., Milwaukee 4, Wisconsin

40 years' experience in the development, manufacturing and application of transformers

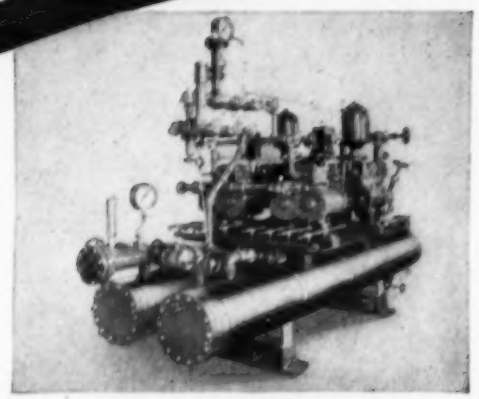
Circle 103 on READ-N-CIRCLE card for more data

Enco Automatic
OIL PUMPING
AND HEATING SYSTEM

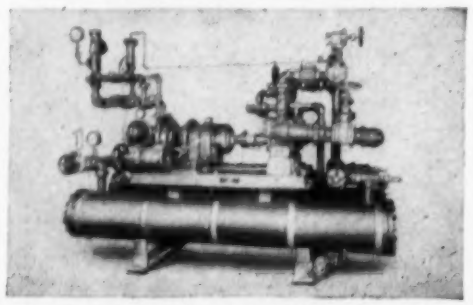
Completly Coordinated

Every detail part of an Enco Automatic Oil-Heating-and-Pumping Unit System is designed, assembled, checked and tested to make sure that it functions as an element of a completely coordinated unit. The sizes of pipes, fittings, valves and other elements are correctly proportioned for the efficient, dependable operation of the unit as a whole. All hand controls are visible and within reach of the operator for quick starting, stopping or cross-over reconnections between duplicate heaters and pumps. Adjustments and cleaning are similarly simplified.

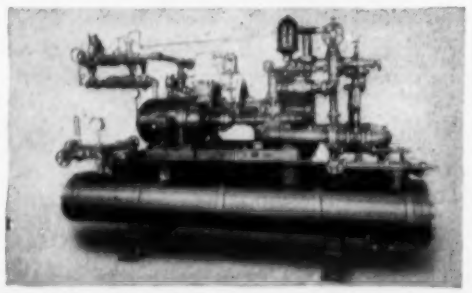
Single or duplicate heaters and electric or steam-driven pumps are used. Interconnected duplicate units give full capacity with either pump or either heater. Capacities range from 100 to 5000 G. P. H. of heavy bunker oil.



Two Horizontal Duplex Piston Type Steam Pumps and two fuel oil heaters—capacity 15 G. P. M. at 250 lb. pressure with either pump or heater.



One Turbine and One Motor Driven Pump and two fuel oil heaters. Capacity 30 G. P. M. at 150 lb. pressure with either pump or heater.



One Horizontal Duplex Piston Type Steam Pump and one Motor Driven Pump and two fuel oil heaters. Capacity 20 G. P. M. at 300 lb. pressure with either pump or heater.

BULLETINS ON REQUEST

OB-53 On oil burning, pumping and heating equipment.

OB-38 Instruction book on care and operation of oil-burner installations.

THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK 6, N.Y.

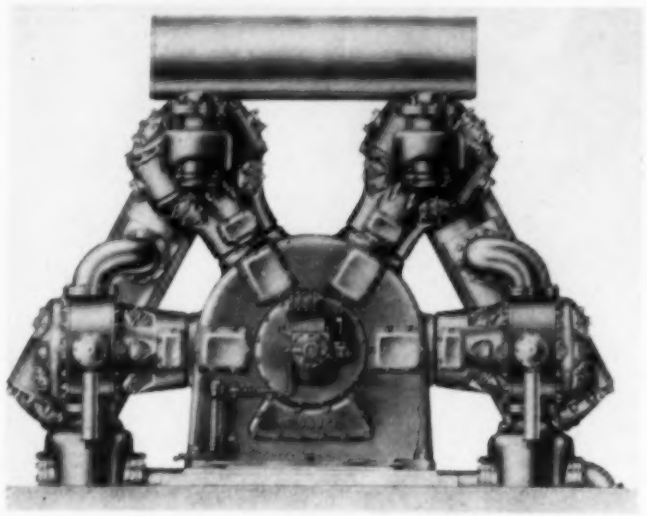
Circle 118 on READ-N-CIRCLE card for more data

new products

. . . starts on page 26

708-Compressor has 350 to 1000-hp range

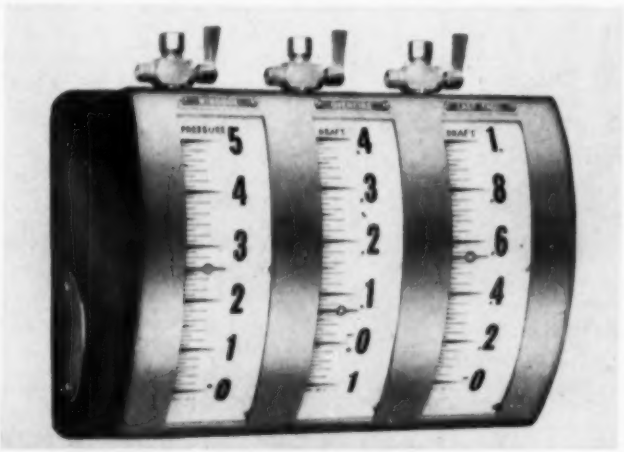
Heavy-duty industrial air compressor is largest package-type available. Compressor is 4-cylinder, two-stage, double-acting, water cooled, semiradial design. Drive



may be by electric motor, either flange-mounted or coupled, or by diesel engine, steam turbine, or turbo-electric combination. Three standard single, and three twin-unit models are available. Models available for altitude use. JOY MANUFACTURING CO.

709-Easy-to-read draft gages save space

Space-saving draft gages give instant, accurate, and continuous record of air flow through boiler. Maximum simplicity is incorporated in design. Direct connection is made from sampler line to a dry, rubber-impregnated silk diaphragm. Aluminum supports on each side of diaphragm provide stiffening for added accuracy. To

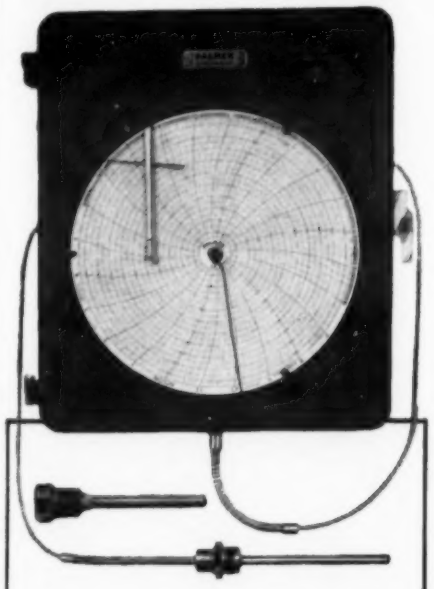


remove fatigue effects, diaphragm movement is governed by beryllium spring. Other components are made of brass or stainless steel. Vertical design permits two instruments to be installed in space required for ordinary single-pointer horizontal gage. Made in projected or semi-flush mountings. CLEVELAND FUEL EQUIPMENT CO.

PALMER

MERCURY ACTUATED
recorders

Into this modern Mercury Actuated Recorder has gone all the skill of Palmer master craftsmen.



Readings are clearer, smoother and more precise than ever thought possible. In fact readings are so amazingly improved that maintenance is never needed under normal uses.

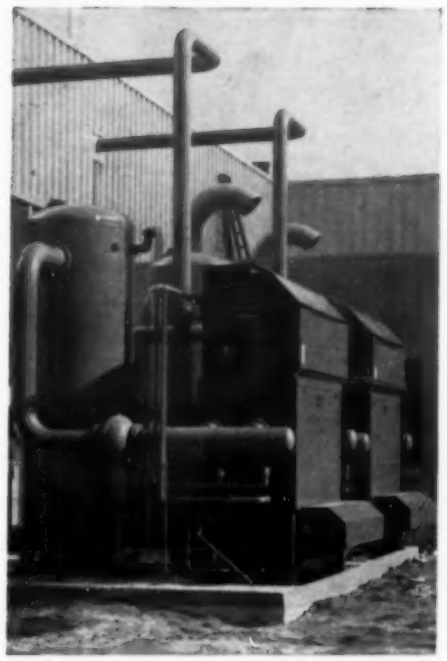
Recording Thermometers feature twelve inch die-cast aluminum case with black wrinkle or white satin finish. Single or multiple pen construction. Electric or spring wound clock, 24 hour or 7 Day Revolution. Flexible Armor and bulb of stainless steel. Ranges —40 to 1000°F. or Equivalent in °C.

Send for Bulletin No. 45

Consult your Classified Directory

PALMER
THERMOMETERS, INC.
Mfrs. of Industrial Laboratory, Recording and Dial Thermometers
Cincinnati 12, O.

Circle 135 on READ-N-CIRCLE card



This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR
• Lower in Cost
• Drier and Cooler

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient.

Drier air gives you better operation and lower costs in using all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air through a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility systems.

Write for Bulletin No. 130

NIAGARA BLOWER COMPANY
Dept. IP-5, 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in
Principal Cities of U. S. and Canada

Circle 106 on READ-N-CIRCLE card

710-Warns of clogged lines in system

Circulating oil system supplies oil under pressure to measuring valves for delivery to bearing points. System monitors its own operation through pressure sensing mechanism, warns of clogged or broken lines in any part of system. Variable-delivery pumping unit permits wide selection range in injections per minute applied to bearing points. Any number of measuring valves can be manifolded together to serve equipment. Valves are manufactured in two capacities for interchangeable installation as required. Temperature-induced changes in oil viscosity have no effect on valve deliveries. THE FARVAL CORPORATION.

711-Valve for high-temperature water

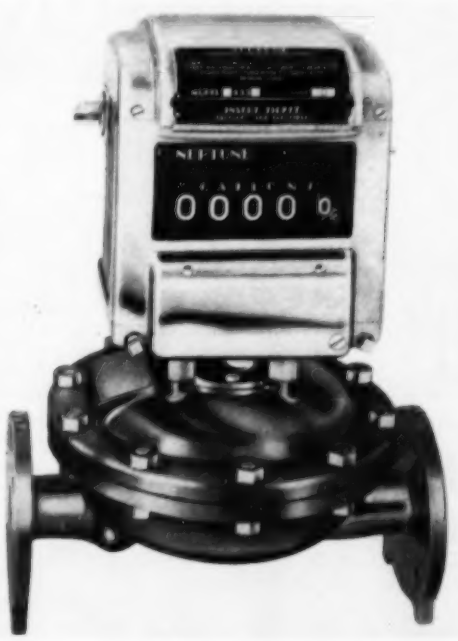
Poppet-type multiport valve is designed and built especially for high temperature work. Good performance results have been obtained with hot zeolite softeners and hot anthracite filters following hot-process lime softeners. HUNGERFORD & TERRY, INC.

MORE INFORMATION

For more detailed free information on these products just circle the key numbers on a READ-N-CIRCLE card on page 29 or 30.

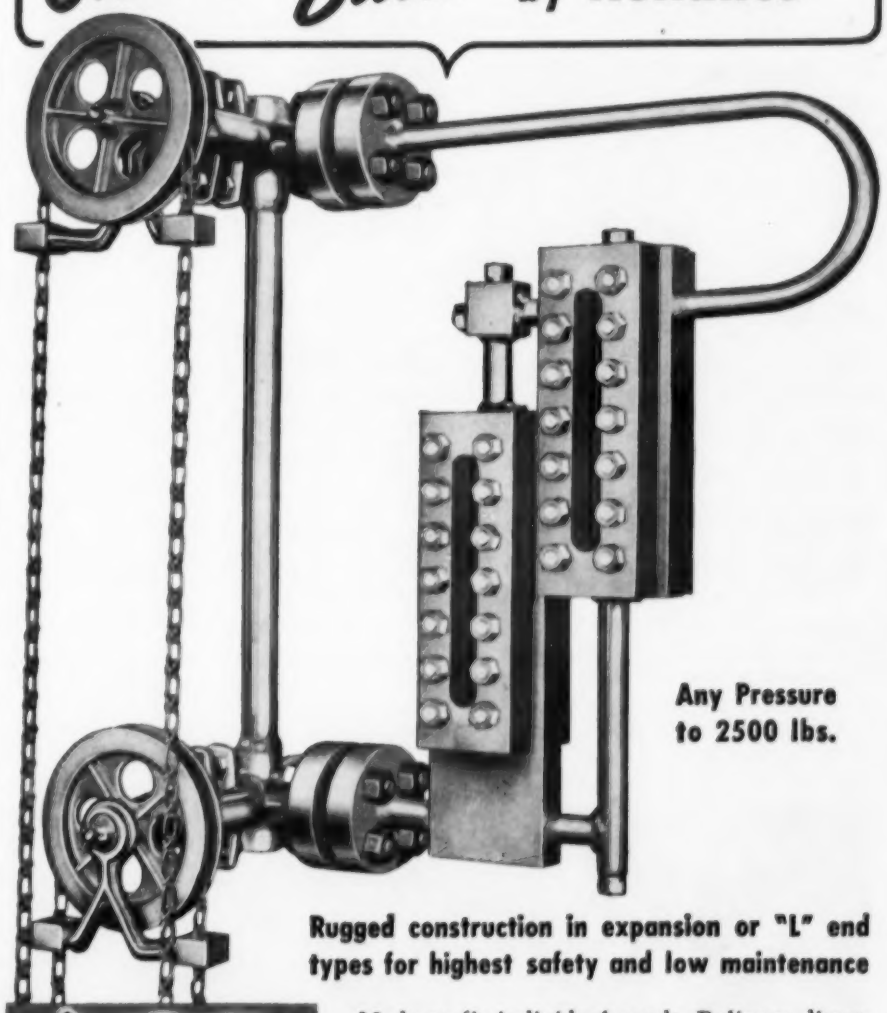
712-Controls, registers corrosive liquids

Positive displacement stainless steel meter has only one moving element exposed to liquid. Makes possible close-metered control over corrosive solutions and



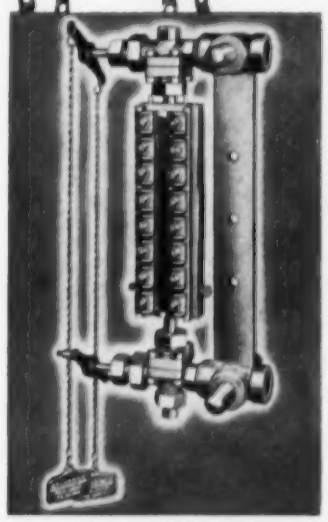
chemicals that must be kept pure. Ends processing problems caused by metal pickup or contamination of liquids being metered. Registers can be calibrated for U.S. gallons, pounds, Imperial gallons, liters, and other units. Capacity is from 20 gpm to 100 gpm for 1½-in. meter. NEPTUNE METER CO.

Direct-to-Drum Gage Assemblies *Custom Built* by Reliance



Any Pressure to 2500 lbs.

Rugged construction in expansion or "L" end types for highest safety and low maintenance



Made to fit individual needs, Reliance direct-to-drum assemblies meet highest engineering and construction standards. Reliance all-welded gage assemblies have more than sufficient ruggedness for severest conditions. Each unit is tested at well over 50% overload before it leaves the factory.

In the expansion tube type, a sturdy tie-tube is welded to both gage valves for rigidity between boiler connections. Gage windows are Mica-protected flat glass (to 1500 lbs.) or non-shattering Micasight — safest gage obtainable for the higher pressures. Valves — heavy duty forged steel, temperatures to 750°. Various combinations possible in other types, pressures 900 to 2500 lbs. Efficient illumination equipment available, including the powerful mercury lamp type. Write the factory or nearest Reliance Representative.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance®
BOILER SAFETY DEVICES

Circle 136 on READ-N-CIRCLE card for more data

basic bulletins

. . . just circle key numbers on READ-N-CIRCLE card on pages 29 or 30

AIR CLEANING EQUIPMENT

501-Do you cool or absorb gases?

Scrubbers for product recovery, gas purification, and elimination of atmospheric pollution are described in Bulletin 203-B. Principles of operation are explained with diagrams, and technical data are included. Six pages. PEABODY ENGINEERING CORP.

502-Dust collection manual

"The Collection and Recovery of Industrial Dusts," Manual 101, discusses types of dust, techniques used in analysis, lists factors which influence choice of equipment, and explains operation. Thirty-two pages. BUELL ENGINEERING CO., INC.

BOILERS AND BOILER ACCESSORIES

504-Blowdown control chart

Determination of rate of boiler blowdown and selection of a correctly sized heat exchanger are made possible with use of simplified Chart JPC, based on total dissolved solids in boiler water. Also given are recommendations for selection of blowdown equipment in accordance with normal operating conditions of boiler installation. HENSZEY CO.

505-Scotch boilers and stoker know-how

How 94 years' experience in boiler manufacture pays off in better construction is described in Bulletin 236. Gives complete data and test results. Sizes range from 6 hp to 250 hp to meet many industrial needs. Twenty-eight pages. THE JAMES LEFFEL & CO.

BUILDING CONSTRUCTION, MATERIALS

506-Resistance-welded grating, tread specs

Catalog describes tailor-made hexagonal cross bar welded grating, treads, decking. One-piece construction with tops of all bars flush gives greater safety. Catalog includes safe load tables, mechanical specifications, engineering data. Twenty-four pages. STANDARD STEEL SPRING DIV. OF ROCKWELL SPRING AND AXLE CO.

CORROSION CONTROL

509-Coal tar coating in tape form

Tapecoat-X protects pipe, pipe joints, fittings, couplings, tanks from corrosion. Self-bonding, easy to apply with a torch. Can be used with primer if desired. Comes in rolls of 2-, 3-, 4-, 6-, 18-, and 24-inch widths. Four pages. THE TAPECOAT CO.

510-Glass cuts smokestack corrosion

Permaglas smokestacks are glass-protected inside and out to protect against acid condensate, thus reducing corrosion. Bulletin SS-202 pictures typical installations. Includes useful installation data. Eight pages. A. O. SMITH CORP.

ELECTRIC DISTRIBUTION

511-Unit substation technical library

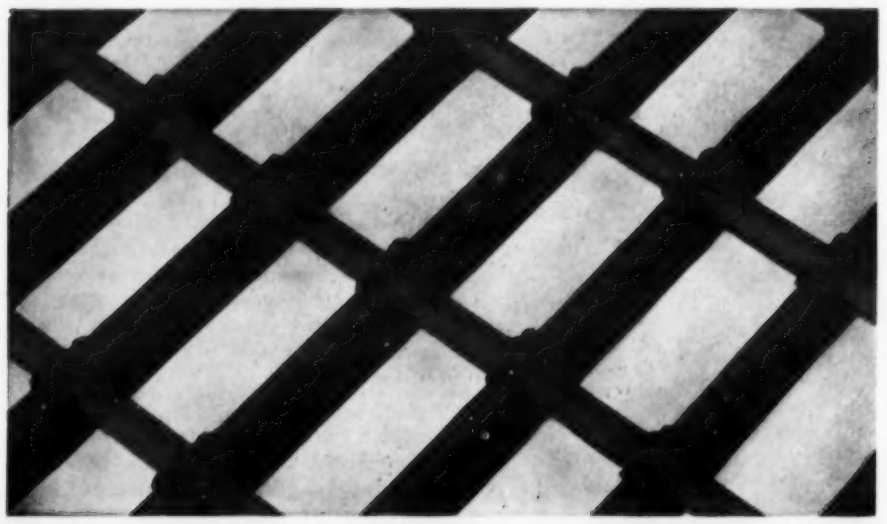
Unit Substation Technical Library consists of seven bulletins on different problems connected with substation design and operation. Titles are: "Distribution Substations in System Planning," "Economical Size Substations for 12-kv Distribution," "Converting a Radial to a Primary Network Distribution System," "Master Unit Substations and Their Relay and Control Arrangements," "Integrating Substation and System Planning Requirements to Reduce Over-all System Investment," "Twenty-Five Years of Progress in Unit Substations," and "Use of Handbooks for Substation Planning Purposes." GENERAL ELECTRIC CO.

512-Correct that low power factor

Booklet 50B describes unit-cell box type capacitors which offer easy-to-install, economical means of correcting low power factor for large or small power consumers. Twenty-eight pages. SPRAGUE ELECTRIC CO.

513-How to choose circuit breakers

Essential information on selection and application of molded case and large air circuit breakers is presented in this Speedfax catalog. Application sections use charts



Hexagonal Cross Bars...Resistance Welding make

Gary WELDED GRATING safer, stronger neat appearing

One piece construction with tops of all bars flush provides safer, longer-lasting open steel flooring. And it's tailor-made to fit your requirements. For typical installations and full details on Gary gratings, stair treads and decking, write for Catalog IP-57

FREE SAMPLE
We'll send this handy paper weight if you request it on your company stationery.

ROCKWELL SPRING & AXLE CO.
Standard Steel Spring Division
4000 EAST SEVENTH AVE., GARY, INDIANA

Circle 119 on READ-N-CIRCLE card for more data

To get more information on products—use the Read-N-Circle card • on page 29-30

NON-FLUID OIL
TRADE MARK REGISTERED

ARE YOU WASTING COSTLY POWER?

Unless every bearing, gear and moving metal surface of your machines and motors is getting correct lubrication, you are losing valuable power that is being converted into destructive heat! Also you are taking a chance that your machinery will break down and wear out quicker.

Correct lubrication means NON-FLUID OIL — the unique lubricant that is neither oil nor grease, but has all of the desirable qualities of both without their drawbacks. NON-FLUID OIL is a highly stable 100% lubricant that keeps lubricating effectively until entirely consumed — without undergoing the usual chemical and physical changes that result in gummy, friction-producing residues.

Don't take our word for it when we say that NON-FLUID OIL far surpasses other industrial lubricants and outlasts them 3 to 5 times. Send for instructive bulletin and free testing sample to try for yourself.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.

1896 61 1957 YEARS OF LUBRICATION SERVICE NON-FLUID OIL TO INDUSTRY

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Birmingham, Ala.	Greenville, S. C.	Greensboro, N. C.
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Columbus, Ga.	Springfield, Mass.	Providence, R. I.
Charlotte, N. C.		St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 124 on READ-N-CIRCLE card for more data

and tables to explain selection of circuit breakers for motor circuits, bus duct, conductors, and transformer secondary applications. Includes latest prices, dimensions, and ordering instructions. Sixty pages. I-T-E Circuit Breaker Co.

ELECTRIC GENERATION

514-Automatic excitation system data

Advantages and limitations of four basic types of automatic excitation systems are given in Bulletin 05R8530. Lists principal component parts used in each. Eight pages. Allis-Chalmers Manufacturing Co.

ELECTRIC UTILIZATION

515-How to select ac motors

Bulletin B-2103-1 gives selection data for motors in frame sizes from 182 to 6085. Includes speed-frequency relationship, NEMA design classes, torque characteristics, NEMA current and torque values, frame selection tables, and dimension charts. Twelve pages. Reliance Electric and Engineering Co.

HEAT EXCHANGERS

516-Condenser, jet air ejector specs

Engineering data in steam condenser bulletin includes method of determining heat transfer rates, pressure drop, tables converting absolute pressure inches Hg to saturation temperature in F. Conseco inter-after condensers normally operate with low condensate flow with twin-element, two-stage steam jet air ejectors. Twenty-four pages. Condenser Service & Engineering Co., Inc.

INSTRUMENTS AND CONTROLS

517-Continuous temperature readings

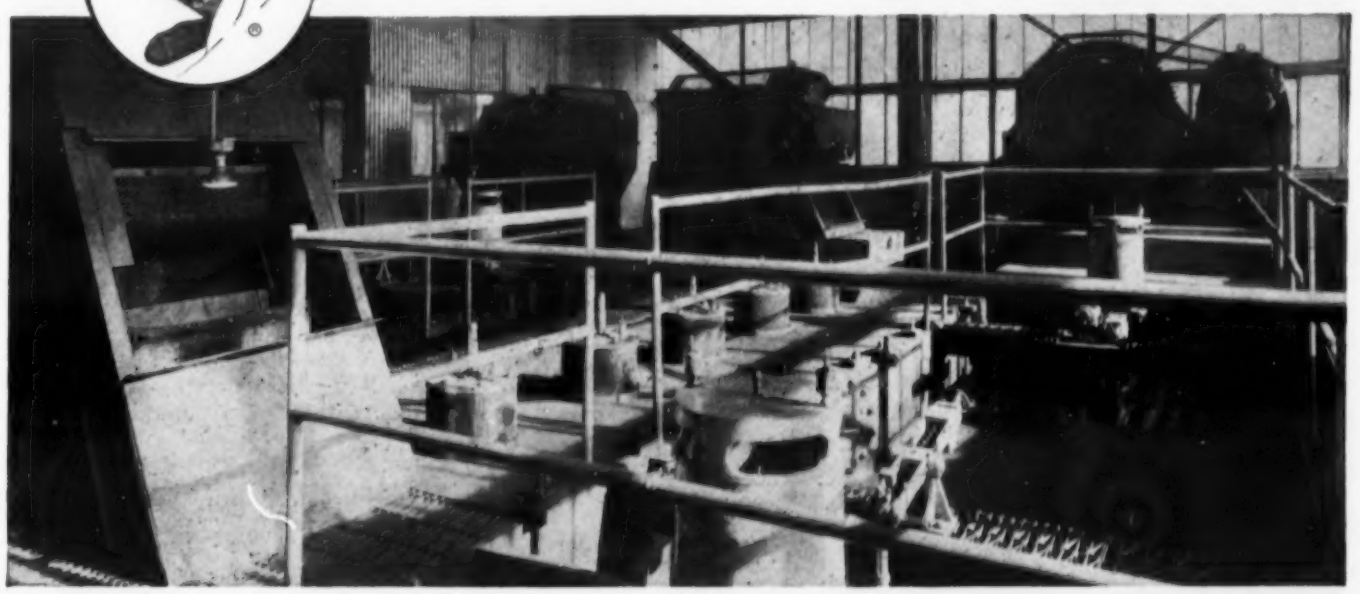
Continuous temperature recording, rapid response to temperature change, high stability of reproducibility,

(continues on page 36)

BASIC BULLETINS SUBJECT INDEX

Air cleaning equipment 34
Boilers and boiler accessories 34
Building construction, materials 34
Corrosion control 34
Electric distribution 34
Electric generation 35
Electric utilization 35
Heat exchangers 35
Instruments and controls 35
Lubrication 36
Maintenance items 36
Materials handling (bulk) 36
Mechanical power transmission 36
Nuclear 37
Pumping equipment 37
Refractories and insulation 37
Vibration and noise control 37
Water supply and treatment 37

WHY CHESSIE'S RAILWAY IS FIRST IN COAL



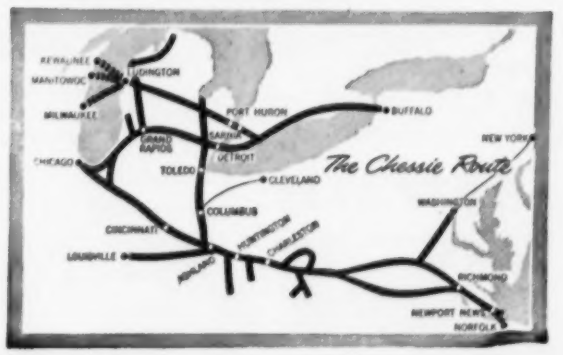
SUPERIOR COAL. The entire output of this mine is processed by automatic compound coal cleaning equipment. Producers on the Chesapeake and Ohio are prepared to supply you with highest quality coal of the type best suited to your needs and processed to your own specifications.

SUPERIOR SERVICE. To its present fleet of 63,780 coal cars—largest in the world—C & O is adding another 8,000. New high-speed yards, new locomotives and a new teletype car reporting system bring you faster, more dependable service.

For dependable deliveries of top quality coals, contact coal producers on the C & O. And for specific help in meeting your own fuel requirements, write to: R. C. Riedinger, General Coal Traffic Manager, Chesapeake and Ohio Railway Co., Terminal Tower, Cleveland 1, Ohio.

Chesapeake and Ohio Railway

WORLD'S LARGEST CARRIER OF BITUMINOUS COAL



Circle 133 on READ-N-CIRCLE card for more data

You get EXACTLY what you set — No More — No Less!

When you use NIAGARA Displacement Meters for process control

Consistent accuracy in liquid measurements is obtained with Niagara Electricontact Meters. Set the gauge for the number of gallons required and accuracy goes into action. The set number of gallons will be exactly measured through the meter and the flow stopped by the closing of a solenoid valve.

Niagara Meters are of the accurate, positive displacement type. Each Niagara Meter is guaranteed to be individually tested and calibrated at the factory to run within close tolerances at all rates of flow within its rated capacity.

Learn all the facts . . . Mail the coupon for complete information.

BUFFALO METER CO.
2933 Main Street
BUFFALO 14, N. Y.

Please send me complete information on the use of Niagara Electricontact Meters for liquid formulations.

Liquid used.....
Flow G.P.M.....°F.....
Name.....
Company.....
Address.....

Circle 134 on READ-N-CIRCLE card for more data

basic bulletins

. . . starts on page 34

and resistance to mechanical shock are features of Rayotube temperature detector described in Bulletin EN-S3. Discusses theory behind heat-radiation measurements of actual surface temperatures and furnace atmospheres. Twenty-six pages. LEEDS & NORTHRUP CO.

518-Switches insure safe operation

Bulletin 856 contains information on full line of mercury switches and controls. Lists mercury switch controls for temperature, pressure, oil burner controls, stoker, liquid-level, and boiler feedwater pumps. Gives advantages of mercury switches, such as visible contact, elimination of contact wear, and seal from hazardous atmospheres, dirt, and corrosion. Fifty-two pages. THE MERCOID CORP.

LUBRICATION

519-Buying silicone lubricants?

Bulletin 6-101 gives properties and performance of various silicone oils, greases, and compounds. Includes helpful technical data. Compares high-speed, high-temperature ball bearing life using both organic and silicone-soap lubricants. Covers influence of bearing load, speed. Eight pages. DOW CORNING CORP.

MAINTENANCE ITEMS

520-Boiler tube reference manual

Handy reference manual gives useful tips on care and preservation of boiler tubes, solves common boiler tube problems. Includes tables, charts, and other pertinent data. Fully indexed. Thirty pages. BOILER TUBE CO. OF AMERICA.

522-Handbook on specialty steels

Distinctive characteristics of a broad range of special purpose steels in terms of end use are given in this comprehensive handbook. It briefly summarizes tool and die steels, stainless steels, silicon and high-nickel electrical alloys, special purpose alloy steels, valve, heat-resisting and super-alloy steels, tubing and pipe, and fine wire. Will help to match the proper steel to the job. Thirty-two pages. THE CARPENTER STEEL CO.

MATERIALS HANDLING (BULK)

524-How to store bulk materials

Storage bins for bulk materials such as ashes, coal, coke, sand or lime are discussed in this bulletin. Contains tables of densities of flowable materials, capacities, description of wall construction, test data, and other relevant engineering data with many photographs. Thirty pages. The NEFF & FRY CO.

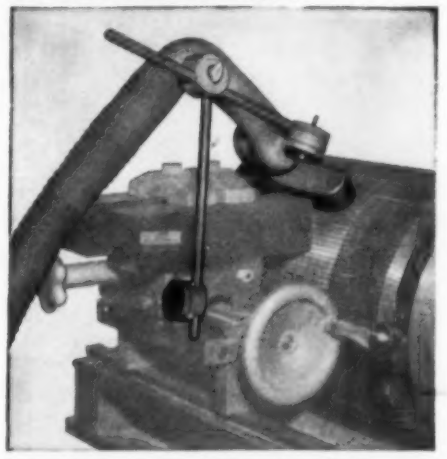
MECHANICAL POWER TRANSMISSION

525-Pocket-size computer calculates for you

Handy Graham Computer can be used as slide rule for computations and for quick solution of formulas involving two variables and a constant. Computer's

an IDEAL idea...

DUSTLESS COMMUTATOR GRINDING!



Vacuum attachment picks up metal and stone dust as it is made . . . keeps it out of machine

- **Compact and simple, it does NOT interfere with work in progress.**
- **Fits all IDEAL industrial vacuum cleaner hoses; mounts on grinder or on motor or generator frame.**
- **Cuts clean-up time, prevents bearing trouble and hard-to-locate short circuits.**

Model No. 24-073 is for small commutators; mounts on Ideal's "Midget" Model Grinder or motor or generator frame. Stationary nozzle covers entire commutator.

Model No. 24-074 mounts on Ideal's "Perfect" or "Ideal" Model Grinder, traverses large commutators with the grinder.

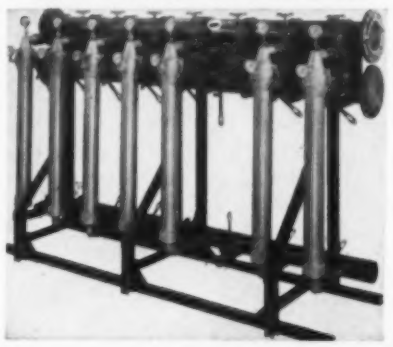
Write for more information on these handy attachments. When writing, also ask for IDEAL's informative series of articles on "Commutator and Slip Ring Maintenance."

IDEAL INDUSTRIES, INC.
1023-E Park Avenue, Sycamore, Illinois
☐ Send more data on vacuum attachment described in this ad.
☐ Add my name to your mailing list for FREE "Commutator & Slip Ring Maintenance" articles.

Name.....
Company.....
Address.....
City.....Zone....State.....

Circle 117 on READ-N-CIRCLE card

ELIMINATE DOWN-TIME
on your Filters and Strainers



Ronningen Model 208 Multiplex Filter with 1 unit removed from line for service—and *all* the others can continue to operate.

Headers: Stainless Steel with Van Stone Flanges

Filters: Bronze Castings, Bronze Couplings, Copper or Stainless Steel Body with Monel Metal or Stainless Steel Filter Element.

Valves: Bronze or Stainless Steel.

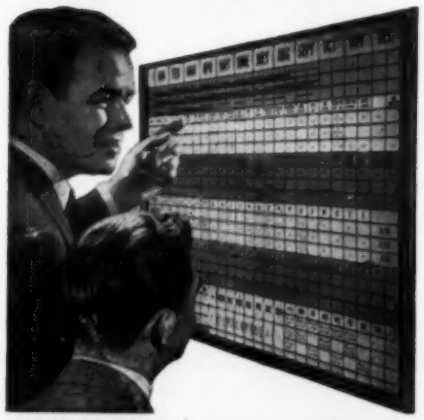
All are Quick Coupling — Non Short-Circuiting. Sealed both ends. Each unit can be back washed and blown down in 5 seconds.

Write for Bulletin 954P
STRAIN AGAIN WITH RONNINGEN
"Particles large or small, we filter them all"

RONNINGEN-PETTER CO.
Vicksburg, Michigan Phone Midway 8-5161

Circle 120 on READ-N-CIRCLE card

How To Get Things Done Better And Faster



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Circle 121 on READ-N-CIRCLE card

use is explained in accompanying pocket-size booklet Thirty-four pages. GRAHAM TRANSMISSIONS INC.

NUCLEAR

526-Nuclear reactor terminology

New booklet banishes fog surrounding nuclear reactor terminology. Gives thumbnail profiles of common reactor types. Tells in nontechnical language essential reactor features. Eight pages. MINNEAPOLIS-HONEYWELL REGULATOR CO.

PUMPING EQUIPMENT

527-Pocket-size pump guide

Bulletin 5000 is a ready reference to help you decide what type pump, in what size and capacity, you need to solve your pumping problem. Includes data on pump dimensions, performance ratings, construction. Twenty pages. DORR-OLIVER INC.

528-How to figure pump heads

How to determine total head against which pump must operate is only one of the valuable sections in Bulletin 353-1000 on the Bilton pump, a general purpose pump suitable for medium and low head service. Twelve pages. BYRON JACKSON PUMPS, INC.

REFRACTORIES AND INSULATION

529-Manual covers history, use of glass

"This is Glass" covers manufacturing methods, applications, and history of glass. Illustrated with charts, drawings, and 130 photographs. Fully indexed. Sixty-six pages. CORNING GLASS WORKS.

VIBRATION AND NOISE CONTROL

530-Acoustic materials reference

Acoustical Materials Association reference manual is a compliation of architectural acoustics and acoustical materials data. Covers nature and causes of sound, remedies for excessive noise, methods of acoustical analysis for sound-conditioning a given area, installation data on acoustical materials. Fifty-eight illustrations supplement text. ACOUSTICAL MATERIALS ASSN.

WATER SUPPLY AND TREATMENT

531-Simplify water treatment

Information to accurately select water treating equipment for any plant, industry, or other institution is contained in this bulletin. Three basic exchange materials are described. Includes water and brine distribution mechanism and exchange material depth. Sketches show direction of water and brine flow during service, brine-rise, and regeneration cycle. Contains specifications including flow rates, exchange capacities, amount of salt, and shipping weight. Eight pages. ILLINOIS WATER TREATMENT CO.

532-Demineralizing handbook

"Handbook on Demineralizing," Bulletin 5800-B, compares various methods of water treatment including demineralizers and evaporators. Covers characteristics of available cation and anion exchange materials and operating costs. Forty pages. COCHRANE CORP. ♦ ♦

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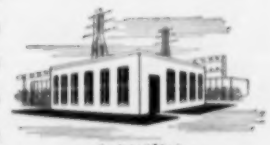
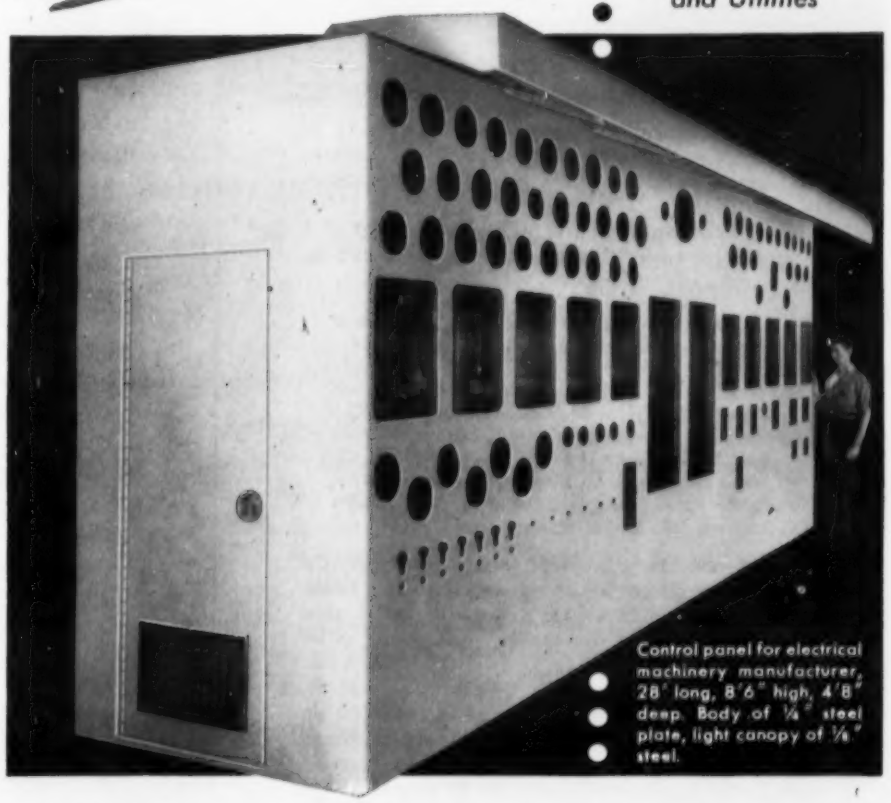


and Utilities



Control panel for electrical machinery manufacturer, 28' long, 8'6" high, 4'8" deep. Body of ¼" steel plate, light canopy of ⅛" steel.

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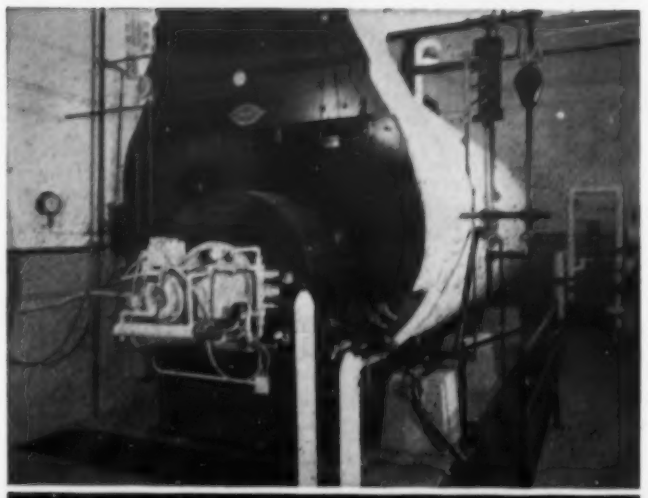

Why U.S. Envelope Co. chose Leffel Scotch Boilers

W. K. Ramsey, engineering manager for the U. S. Envelope Company, knows boilers—his company has been operating boilers for 40 to 50 years in their 15 plants.

U. S. Envelope recently purchased two Leffel boilers. Here's what Mr. Ramsey had to say about this purchase:

"In light of (our) experience, and after a thorough canvass of the field, we recently purchased two of your 175 HP Leffel Scotch Type boilers. One of these was installed in our Central States Division, Indianapolis, in 1955. The other went into our National Division, Waukegan, Illinois (shown above) in July of (1956)...

"Our confidence in the rugged dependability, long life, and freedom from expensive repairs represented by Leffel Boilers is evident."

When you buy a boiler, don't be misled by the exaggerated claims so common in today's boiler advertising. U. S. Envelope's choice of Leffel, after a careful survey of the whole boiler field, is believable evidence of the rugged reliability of Leffel boilers.

Bulletin 236, free on request, gives complete details on Leffel boilers for oil, gas or coal firing. If you need help in planning your boiler installation, Leffel engineers—backed by 95 years of experience in efficient steam generation—are available for consultation without obligation. Just mail the coupon below.

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MORE EFFICIENT STEAM GENERATION FOR 95 YEARS

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NAME_____ TITLE_____

COMPANY_____

STREET_____ CITY_____ STATE_____

Circle 105 on READ-N-CIRCLE card for more data

Air conditioning at RCA

. . . starts on page 15

blown to atmosphere. It is now wholly chargeable to generation.

Our steam supply is normally generated at 850 psig and 750 F total temperature. This steam is used in two double-extraction condensing turbines. Steam is extracted at 175 psig and 550 F, and at 20 psig and 350 F. Exhaust is at 2 in. Hg. absolute.

how we use extraction steam

Steam at 175 psig is used for power generation in condensing units, for station service, for plant process, and for heating areas remote from the powerhouse. Steam at 20 psig is used for plant process and for plant heating. A normal winter operating cycle is shown in Fig. 1.

Our first air-conditioning demand was for product control in some centrally located areas. This was met by installing a 550-ton central-station-type York air-conditioning unit that uses a 175-psig Murray turbine as prime mover. This installation helped equalize summer and winter steam demand at this pressure, and enabled us to keep nearly the same year round extraction rate.

Continued demand for air conditioning, particularly in widely scattered locations, made package units with 5- and 8-ton capacity most economical for large areas. Window units with ¾- and 1-ton capacity were used for smaller offices and for certain fringe areas. This increase in service boosted power demand so much that our greatest demand came in the summer. This condition again upset our operating cycle. The extraction load no longer balanced the power load. A typical summer operating cycle is shown in Fig. 2.

FIG. 5 — PREDICTED HEAT BALANCE

June 27, 1956

	850 psig lb/hr	175 psig lb/hr	20 psig lb/hr	Condensate lb/hr	Output kw
No. 1 Boiler	100,000				
No. 2 Boiler	95,000				
	195,000				
H. P. Aux.	10,000		10,000		
No. 3 Turbine	95,000	70,000	13,000	12,000	2,850
No. 4 Turbine	90,000	70,000	8,000	12,000	2,750
	195,000	140,000	31,000	24,000	5,600
No. 5 Turbine		62,000		62,000	2,600
No. 6 Turbine		42,000		42,000	2,400
Auxiliaries		11,000	less 10% loss —	9,900	
Closed Heater		9,500	1,235	8,265	
No. 1 Air Cond. Plant		8,000		8,000	
		7,500	less 10% loss —	6,750	
	195,000	140,000	32,235	160,915	10,600
No. 2 Air Cond. Plant			12,000	12,000	
			20,235 less 10% loss	18,211	
			32,235	191,126	
			Losses	3,874	
				195,000	

We restored our operating balance in 1956, when air conditioning was required in two buildings adjacent to the powerhouse. A study was made that considered location, power requirements, water requirements, and areas to be serviced.

decided against packaged units

We determined that package units would not be practical here because of a cooling-water shortage. The main chilled-water supply and return lines ran the entire building length and were of ample size. On this basis, a 500-ton Worthington central station unit was selected.

Because our power demand had peaks during the summer, and because any further load would push us to the limit, we decided that the new prime mover should be a condensing turbine. This would exhaust into the same condenser as the 550-ton

FIG. 4 — ACTUAL HEAT BALANCE

June 27, 1956

	850 psig lb/hr	175 psig lb/hr	20 psig lb/hr	Condensate lb/hr	Output kw
No. 1 Boiler	95,000				
No. 2 Boiler	95,000				
	190,000				
H. P. Aux.	10,000		10,000		
No. 3 Turbine	90,000	70,000	9,000	16,000	2,750
No. 4 Turbine	85,000	70,000		15,000	2,550
	190,000	140,000	19,000	31,000	5,300
No. 5 Turbine		62,000		62,000	2,600
No. 6 Turbine		42,000		42,000	2,450
Auxiliaries		11,000	less 10% loss —	9,900	
Closed Heater		9,500	1,235	8,265	
Plant		7,500	less 10% loss —	6,750	
No. 1 Air Cond.		8,000		8,000	
	190,000	140,000	20,235	167,915	10,350
Plant			20,235 less 10% loss	18,211	
				186,126	
			Losses	3,874	
				190,000	

FIG. 6 — ACTUAL HEAT BALANCE

September 5, 1956

	850 psig lb/hr	175 psig lb/hr	20 psig lb/hr	Condensate lb/hr	Output kw
No. 1 Boiler	100,000				
No. 2 Boiler	95,000				
	195,000				
No. 1 Aux.	6,000		6,000		
No. 2 Aux.	6,000		6,000		
No. 3 Turbine	90,000	73,000		17,000	2,600
No. 4 Turbine	93,000	66,000	13,000	14,000	2,600
	195,000	139,000	25,000	31,000	5,200
No. 5 Turbine		60,000		60,000	2,600
No. 6 Turbine		45,000		45,000	2,400
Auxiliaries		8,000	less 10% loss —	7,200	
Closed Heater		7,000	910	6,090	
No. 1 Air Cond.		5,000		5,000	
Plant		14,000	less 10% loss —	12,600	
	195,000	139,000	25,910	166,890	10,200
No. 2 Air Cond.			6,300	6,300	
Plant			19,610 less 10% loss	17,649	
			25,910	190,839	
			Losses	4,161	
				195,000	

FIG. 7 — ACTUAL HEAT BALANCE

September 14, 1956

	850 psig lb/hr	175 psig lb/hr	20 psig lb/hr		Condensate lb/hr	Output kw
No. 1 Boiler	103,000					
No. 2 Boiler	108,000					
	211,000					
No. 1 Aux.	6,000		6,000			
No. 2 Aux.	6,000		6,000			
No. 3 Turbine	84,000	66,000	3,000		15,000	2,300
No. 4 Turbine	96,000	62,000	15,000		19,000	2,650
850/175 P. I.	19,000	19,000				
	211,000	147,000	30,000		34,000	4,950
No. 5 Turbine		45,000			45,000	2,200
No. 6 Turbine		46,000			46,000	2,300
Auxiliaries		11,000	less 10% loss —		9,900	
Closed Heater		10,000	1,300		8,700	
Plant		35,000	loss 10% loss —		31,500	
	211,000	147,000	31,300		175,100	9,450
Worthington			8,100		8,100	
Plant			23,200 less 10% loss		20,880	
			31,300		204,080	
			Losses		6,920	
					211,000	

prime mover. A 20-psig Murray turbine was selected to improve our cycle by providing summer usage for steam at this pressure. A predicted cycle was drawn up, (Fig. 3), and an actual steam balance was taken (Fig. 4). This was projected to include the new unit, called No. 2 air-conditioning unit (Fig. 5).

This new unit was installed and put in service in late summer. A running check was made with both air-conditioning units in service. Steam and power loading balanced out as shown in Fig. 6. With all possible variables considered, these actual results were so close to the predicted results as to fully justify selection of the unit and drive.

Later, another running check was made with only No. 2 unit in service. The actual steam balance at this time was as shown in Fig. 7. Again, the actual results justified the selection.

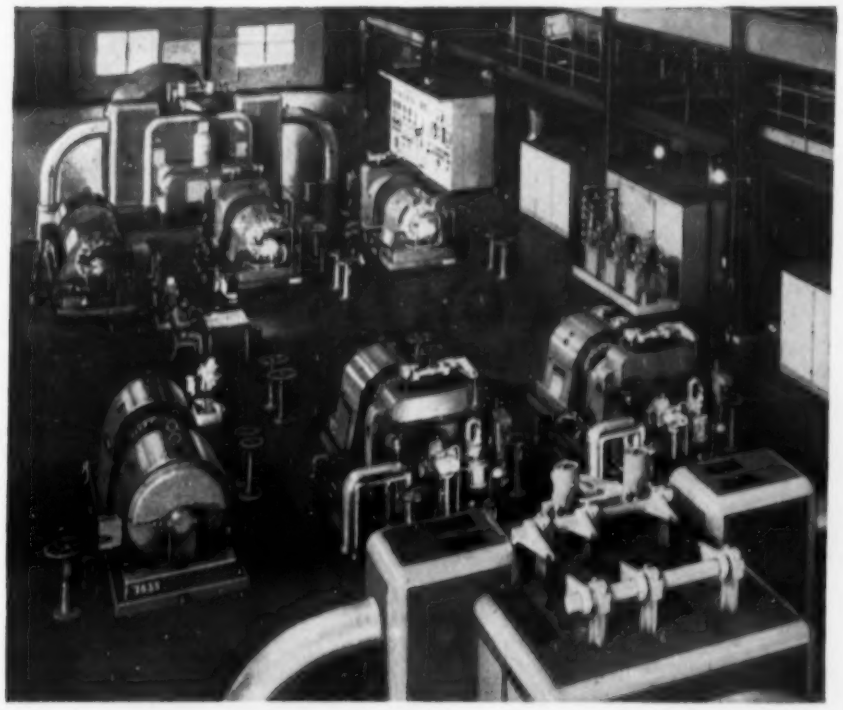
summer heat balance is good

Installing these two units gives us a summer heat balance that compares favorably with our winter balance. This improved summer economy, due to better heat rate, enables us to keep our power costs down in spite of advancing fuel and labor costs.

Some plant areas require year-round air conditioning to ensure a dust-free atmosphere for product control, and to remove processing heat. In winter, we supply chilled water, at about 45 F, direct from the water treating plant. This water is pumped through the air-conditioning circuit, where it has a temperature pickup of about 10 F. After completing the circuit, the water is collected and re-used as process water in the plant.

This gives us ample time to service our two mechanical units in the off season. It also helps to conserve water and it reduces our plant operating costs. ♦ ♦

What makes a barrel-type boiler feed pump *stay in service?*



Here are some of the design features that assure dependability

Today's modern multi-stage centrifugal pumps for boiler feed service are the result of years of research and design. To provide efficient service *plus* dependability, De Laval has incorporated these important features in its barrel-type pump.

Double Volute Diaphragms

Double volute diaphragms provide for radial hydraulic balance and assure a continuous rising head characteristic from the design point to shut-off. *RESULT—Higher efficiencies are maintained over a wider range of operation than are generally obtained with other forms of velocity pressure conversion.*

Individual Diaphragm Bolting

Elimination of rabbet fits and gaskets permits straight metal-to-metal contact of adjacent lapped faces of the diaphragms which are individually bolted together to maintain tight joints and ease of assembly. *RESULT—Positive assurance against inner case leakage, complete elimination of misalignment causes and a minimum of distortion from sudden temperature changes.*

Positive Sealing Between Suction and Discharge Chamber

Inner assembly is held at the inner high pressure joint at the suction end of the barrel, against a flexitallic gasket, with through bolts. The joint between the suction and discharge chambers is made tight during assembly—remains tight whether pump is operating or idle. *RESULT—No possibility of leakage or gasket loosening due to changes of force on the inner joint.*

Bare Shaft

Bare shaft construction with split ring-shrink fit method of impeller mounting permits a scalloped shaft design and eliminates the need for spacer sleeves between impellers. *RESULT—Better hydraulic conditions at the eye of the impeller and elimination of spacer sleeves—the greatest cause of shaft warpage.*

Wearing Rings

Diaphragms and impellers have renewable wearing rings. Impeller rings are threaded on the impeller hubs against rotation, and diaphragm rings are held by a breech lock fit in the diaphragms. *RESULT—Construction permits renewal of original clearances without major part renewal or modification. Labyrinth type diaphragm ring results in minimum leakage over a longer period of time than with close clearance flat rings.*

IMO Oil Pump

A De Laval IMO pump designed for high speed operation is direct-connected to the outboard end of the barrel pump shaft, and is sized to lubricate both pump and driver bearings. *RESULT—Quiet, pulsation-free, positive displacement IMO pumps, assures positive lubrication and eliminates the need of extra shaft length and mechanical complications required by gear drive lube oil pumps.*

BULLETIN CONTAINS HELPFUL DATA

This De Laval bulletin on the barrel-type boiler feed pump covers all major design points . . . has cross-section cut-away illustration for easy reference. Write on your business letterhead for your copy of Bulletin 1506 to De Laval Steam Turbine Company, 857 Nottingham Way, Trenton 2, New Jersey.

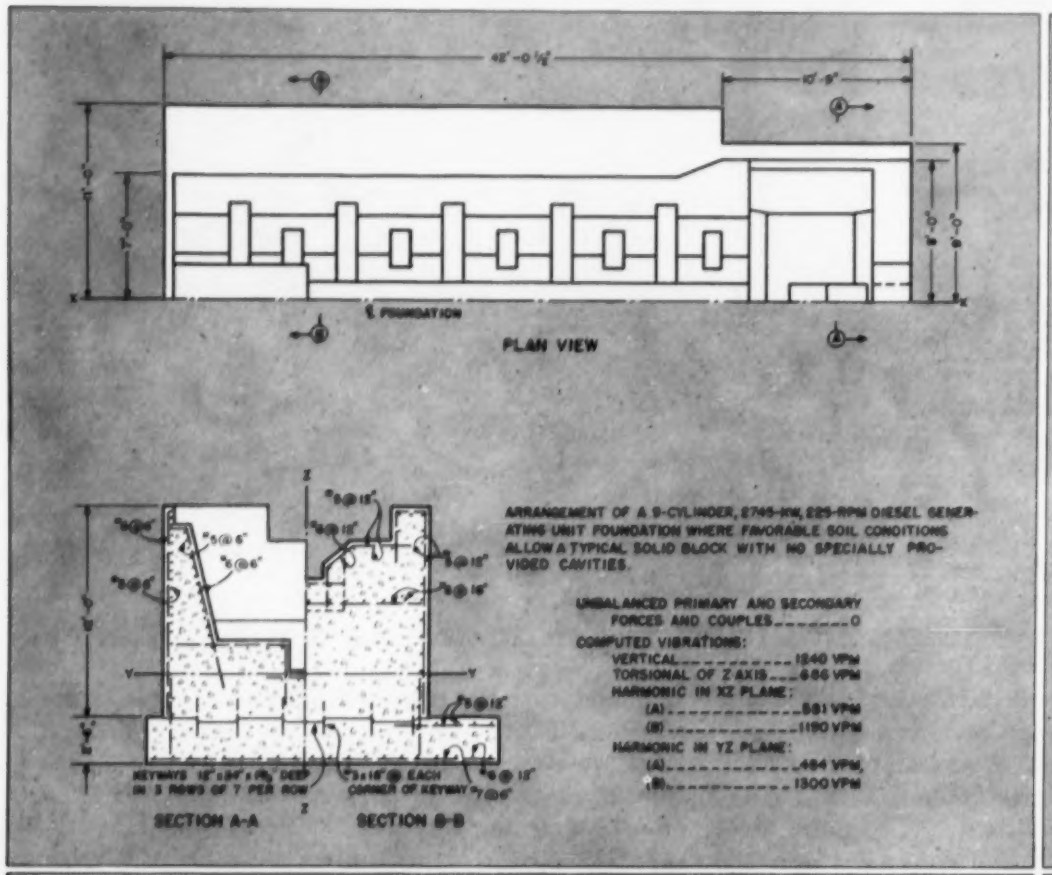
Circle 138 on READ-N-CIRCLE card for more data

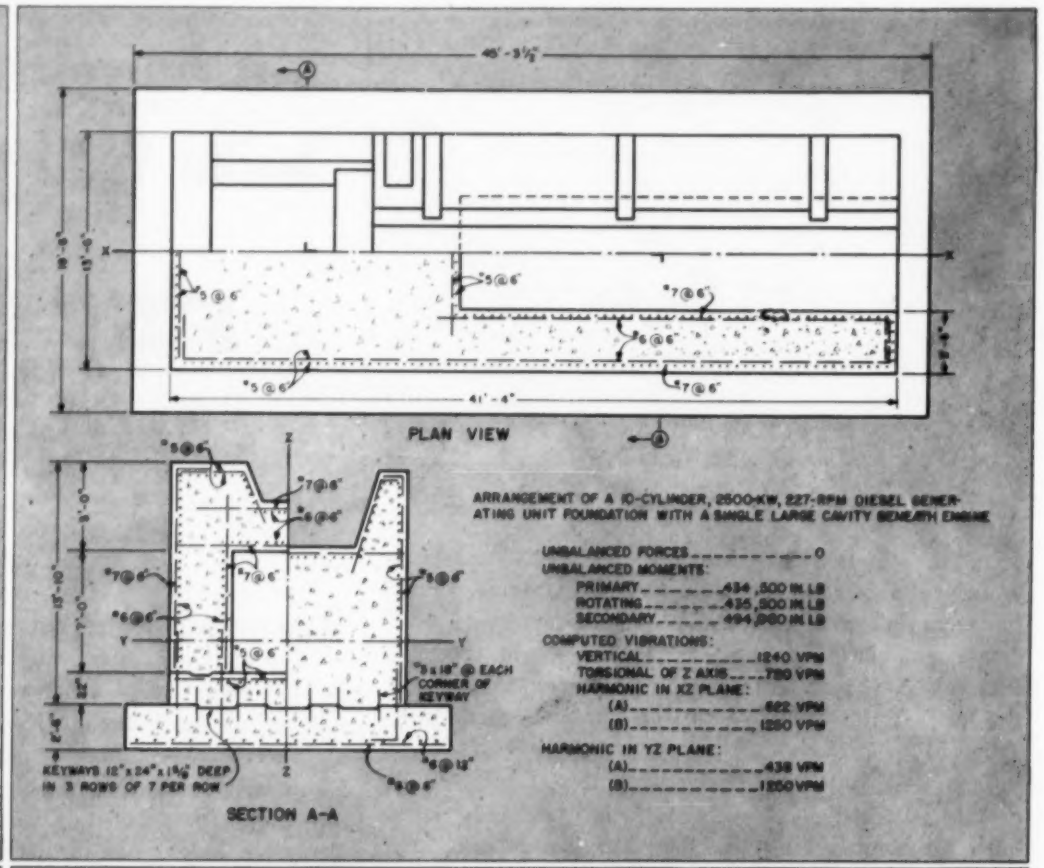
Diesel foundations

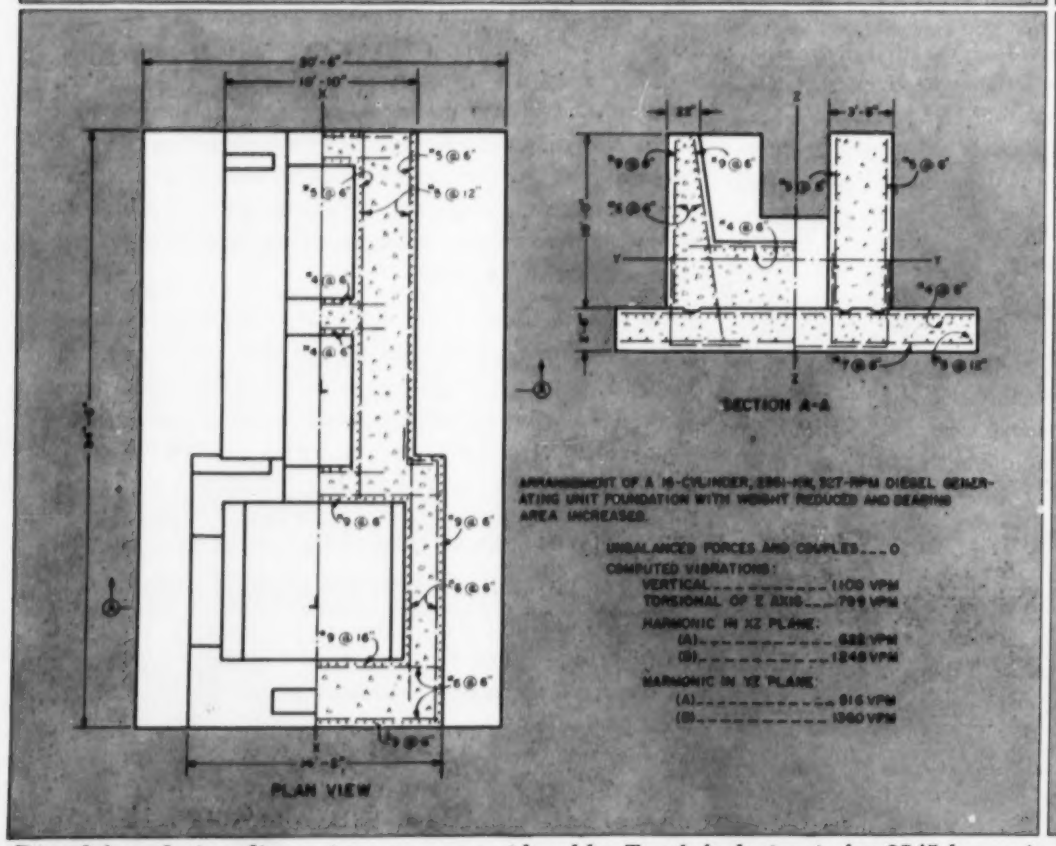
. . . starts on page 16

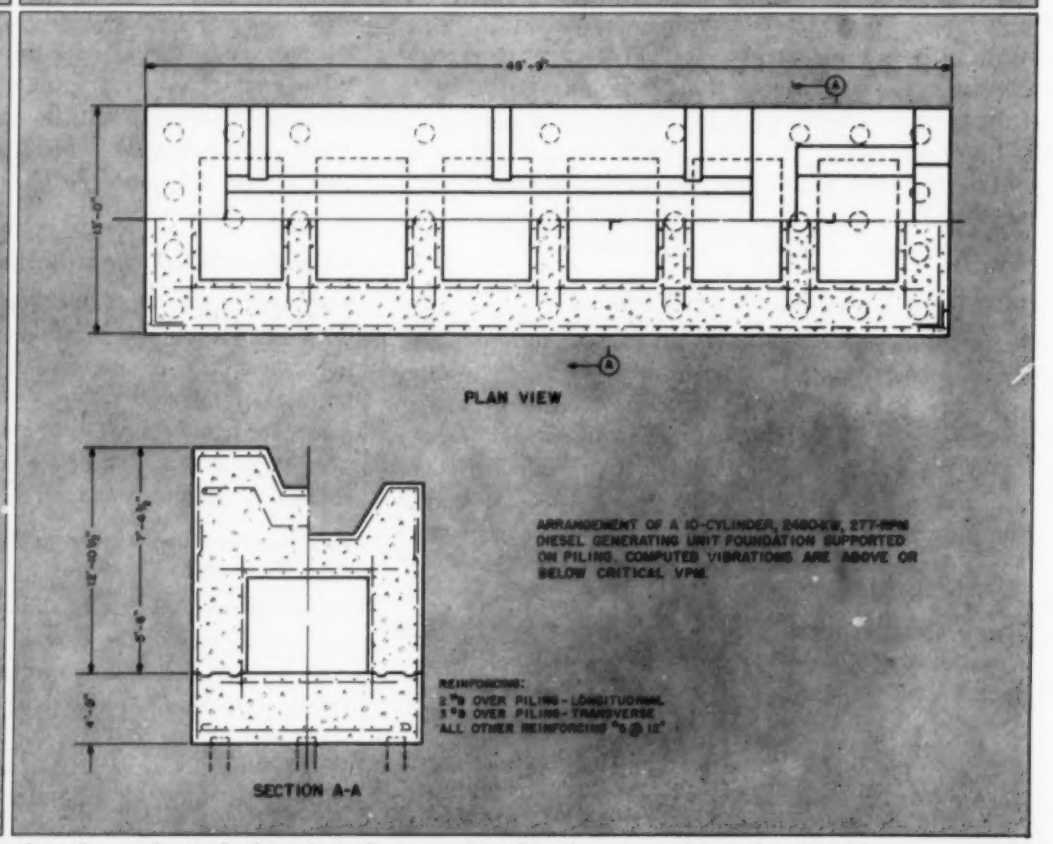
direction, where W is wt/sq in. of bearing area. Coefficients C and S are used in determining harmonic and torsional vibrations.

Selection of coefficients C and S must be made by an engineer thoroughly familiar with soil mechanics. Both values are usually chosen to provide a reason-


PLAN VIEW
SECTION A-A
SECTION B-B
ARRANGEMENT OF A 9-CYLINDER, 2745-KW, 225-RPM DIESEL GENERATING UNIT FOUNDATION WHERE FAVORABLE SOIL CONDITIONS ALLOW A TYPICAL SOLID BLOCK WITH NO SPECIALLY PROVIDED CAVITIES.
UNBALANCED PRIMARY AND SECONDARY FORCES AND COUPLES 0
COMPUTED VIBRATIONS:
VERTICAL ..... 1240 VPM
TORSIONAL OF Z AXIS ..... 696 VPM
HARMONIC IN XZ PLANE:
(A) ..... 581 VPM
(B) ..... 1190 VPM
HARMONIC IN YZ PLANE:
(A) ..... 484 VPM
(B) ..... 1300 VPM


PLAN VIEW
SECTION A-A
ARRANGEMENT OF A 10-CYLINDER, 2500-KW, 227-RPM DIESEL GENERATING UNIT FOUNDATION WITH A SINGLE LARGE CAVITY BENEATH ENGINE
UNBALANCED FORCES 0
UNBALANCED MOMENTS:
PRIMARY ..... 434,500 IN LB
ROTATING ..... 435,500 IN LB
SECONDARY ..... 494,000 IN LB
COMPUTED VIBRATIONS:
VERTICAL ..... 1240 VPM
TORSIONAL OF Z AXIS ..... 730 VPM
HARMONIC IN XZ PLANE:
(A) ..... 602 VPM
(B) ..... 1250 VPM
HARMONIC IN YZ PLANE:
(A) ..... 438 VPM
(B) ..... 1250 VPM


PLAN VIEW
SECTION A-A
ARRANGEMENT OF A 16-CYLINDER, 2351-KW, 327-RPM DIESEL GENERATING UNIT FOUNDATION WITH WEIGHT REDUCED AND BEARING AREA INCREASED.
UNBALANCED FORCES AND COUPLES 0
COMPUTED VIBRATIONS:
VERTICAL ..... 1100 VPM
TORSIONAL OF Z AXIS ..... 799 VPM
HARMONIC IN XZ PLANE:
(A) ..... 688 VPM
(B) ..... 1248 VPM
HARMONIC IN YZ PLANE:
(A) ..... 816 VPM
(B) ..... 1360 VPM


PLAN VIEW
SECTION A-A
ARRANGEMENT OF A 10-CYLINDER, 2480-KW, 277-RPM DIESEL GENERATING UNIT FOUNDATION SUPPORTED ON PILING. COMPUTED VIBRATIONS ARE ABOVE OR BELOW CRITICAL VPM.

Diesel foundation dimensions vary considerably. Top left design is for 2745-kw unit (total weight including foundation, 1610 kips); top right is for 2500-kw unit with total weight of 1485 kips; lower left is for 2351-kw unit with total weight of 1370 kips; and lower right is for 2480-kw unit with total weight of 1517 kips.

ably wide safety margin and to allow for errors.

Numerical values of the dynamic subgrade coefficient C for most soils have been found to fall usually between the limits of approximately 145 lb/cu in. and 1500 lb/cu in. Values of coefficient S have been found to be between approximately 70 lb/cu in. and 750 lb/cu in. Allowable static pressure on soil usually varies in the range of approximately 1000 lb/sq ft to 2500 lb/sq ft.

Much soil-mechanics research still has to be done to provide more reliable information about dynamic subgrade coefficients. Magnitude of these coefficients increases with static load, and probably decreases as loaded area increases. Shape of foundation bearing area may have some influence on C and S values, too.

Dimensions of diesel generating units and their foundations vary considerably among different capacities, designs, and makes (page 40).

Here is a sample dynamic computation of vertical vibrations for a case in which basic data has been obtained by using the form in the next column. Unit has a rotative speed of 360 rpm with unbalanced primary and secondary forces. Static pressure on the soil has worked out to 1570 lb/sq ft, or 10.95 lb/sq in. The value of 540 lb/cu in. has been selected for coefficient C.

Then, elastic deflection of soil,

$$d_s = \frac{10.95}{540} = 0.0202 \text{ in.}$$

Vertical vibrations,

$$n = \frac{187.7}{\sqrt{0.0202}} = 1315 \text{ vpm}$$

From the above, it is determined that the foundation is not in resonance in the vertical direction because the computed vibrations are sufficiently different from the 360 rpm rotative speed (primary forces) or twice that value, 720 (secondary forces). If this computation had indicated a condition close to resonance, it would have been necessary either to change the foundation dimensions so as to substantially alter the weight, or to change the base slab dimensions so as to substantially alter unit static pressure on the soil. A combination of these two adjustments could have been used.

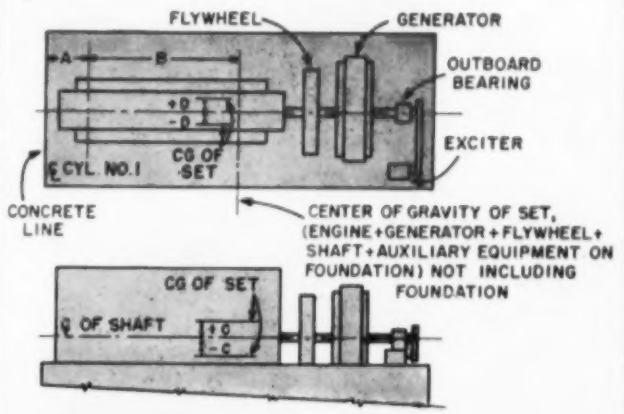
computation is complicated

Complete computation of all vibrations in a block foundation (there are usually six of them) is not easy. The problem is complicated, and because of the great variety of engine types and soil conditions, different approaches are often necessary.

In applying these principles to design for the three speed ranges, various effects may be noted.

Range 1. In the case of a foundation placed on soil, the engineer should strive for a design that will result in a natural foundation frequency higher than the rotative speed (also double the rotative speed if secondary unbalanced couples and forces are present). This may be achieved by decreasing the value of d_s. In formula $d_s = \frac{W}{C}$, the value of W (pounds per square foot) can be decreased by widening the base slab and also, if necesary, by decreasing the foundation weight itself by placing cavities within the foundation block. Value of C does decrease slightly if W decreases, but usually this will not upset benefits from this procedure.

Experience shows that the upper frequency limit that can be achieved in this manner is usually between 500 and 600 vpm.



INFORMATION REQUIRED

Engine serial number		
Rotative speed		rpm
Bore		in.
Stroke		in.
No. of cylinders		
Length of connecting rod		in.
Crank radius		in.
Weight of reciprocating parts		lbs.
Unbalanced forces and couples, [location, magnitude, and direction (primary and secondary)]		
Distance from concrete line to centerline cylinder No. 1	A	in
Distance from centerline cylinder No. 1 to center of gravity of set	B	in.
Distance from centerline shaft to center of gravity of set	C	in.
Distance from centerline shaft to center of gravity of set	D	in.
Weight of generator stator		lbs.
Weight of generator rotor		lbs.
Weight of exciter		lbs.
Weight of outboard bearing		lbs.
Weight of generator shaft		lbs.
Weight of flywheel		lbs.
Weight of auxiliary equipment on foundation		lbs.
Starting torque		ft lbs.
Stopping torque (following loss of fuel without load on generator.)		ft lbs.
Stopping torque (following loss of fuel with full load on generator.)		ft lbs.
Weight of engine (complete.)		lbs.
Total weight of set		lbs.

This form may be used to help assemble basic data required for diesel generator unit foundation design.

In the case of a foundation on piling, the procedure is different. Usually only one or two types of vibrations are higher than 500 vpm, the others being considerably lower (often between 100 and 250 vpm). A very satisfactory foundation could also be made by adjusting the number of piles and their location, and by introducing battered piles with resulting vibrations having frequencies both above and below the critical range.

Range 2. Foundations that cannot easily be designed without the use of springs belong to this range. In this range it is difficult to determine a foundation shape that will result in all vibration frequencies being safely beyond the rotative speed critical ranges. If such diesel generating units have secondary unbalanced couples and forces, the condition is even worse because forced frequencies twice as high then may be critical also.

If springs are selected with proper deflection under static load, the foundation can be safely designed with resulting vibrations much below the lowest value of critical frequency ranges.

consider using springs

Because more and more units with higher rotative speeds are being installed today, serious consideration should be given to the slight additional cost required for springs.

(continues on page 43)

Here's a Strainer that's a little better... YET COSTS NO MORE!
ARMSTRONG STEEL
① Stainless Steel Screen
② Blowout-Proof Gasket
③ Easy Screen Removal

1. Stainless Steel Screen—Type 430 stainless steel screen—either perforated with .045" dia. holes, 225 per sq. in., or 20 x 100 mesh wire cloth—highly corrosion resistant.

2. Blowout-Proof Gasket—a stainless-clad asbestos gasket *inside* the strainer body is locked in place by the bushing. Only a light torque is needed for a leaktight seal.

3. Easy Screen Removal—machine screw threads instead of pipe threads make bushing and screen easy to remove.

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Industry Power's

News in Photos

• This unusual wafer valve disc, left, weighs 1701 lbs. Entire disc was cast in a single piece, with center of each side cored. Metal sections or skins are ¾-in. thick, made of type 304 stainless steel. Valve is 48-in. dia, will be used in circulating water system through which highly corrosive salt water will pass. Valve, cast by Allegheny Ludlum Steel Corp. for W. S. Rockwell Co., will be used in Southern utility's plant . . . . •Ralph J. Cordiner, left, president of General Electric Company, receives Economic Club of New York's first Gold Medal Award for Management from William L. Kleitz, club president. Medal is awarded "to recognize excellence in management and to emphasize contributions made by the executive and his company to the strength of our nation and to the prosperity of our people." Presentation was made during club's 50th anniversary celebration . . . . •Over 19 tons at a pass! That's what this special coal blade enables International TD-24 to move at the Appalachian Electric Power Company's, Kanawha River plant, Glasgow, W. Va. "Wings" on the blade permit the TD-24 to shift 900 tons/hr coal. Feat is accomplished over 125-ft route from surge pile to stockpile.

• Light coil spring added to Thos. C. Wilson Co.'s tube expander, right, saves operator time and effort in repositioning expander cage on mandrel after expanding each tube. Spring causes expander cage to move forward automatically as expander is drawn from tube . . . . •World's most powerful trailer-mounted diesel generating plant has been built by Fairbanks, Morse & Company. Shown top right, plant meets size, weight requirements for over-the-highway movement. Rated at 675 kw, generator produces one-third more power than largest previous mobile generator. Unit was recently delivered to U.S. Navy's Bureau of Yards and Docks . . . . •Bottom right photo shows 98-ton, 1800-rpm rotor for 300-mw steam turbogenerator being lowered into bearings at bottom of Allis-Chalmers' new 18-ft deep test pit. Pit will be used for precision balancing and overspeeding turbogenerator rotors under temperature conditions simulating actual operations.

Diesel foundations

. . . starts on page 16

Since frequency computations are only approximate, you cannot be sure during design as to what performance will occur in actual operation if no springs are used in this foundation type. The safety margin is usually narrow between computed vibrations and critical forced frequency.

If piling is used to support this type of foundation, you may be able to avoid using springs.

Range 3. Here an attempt should be made to increase the value of W by making the base slab as narrow as possible. Any increase in the foundation weight will be favorable. Therefore, solid block foundations are used to advantage for engines operating at 1200 rpm or more. This procedure brings the natural frequency below the rotative speed of the whole unit.

Secondary unbalanced forces or couples are not important here.

In addition to dynamic design, structural design also must be investigated, considering material fatigue and the dynamic forces that increase static load. The concrete block or box should be reinforced around all surfaces. Special consideration should be given to the surface directly supporting the machinery, because higher temperatures in that area may cause cracks in the concrete.

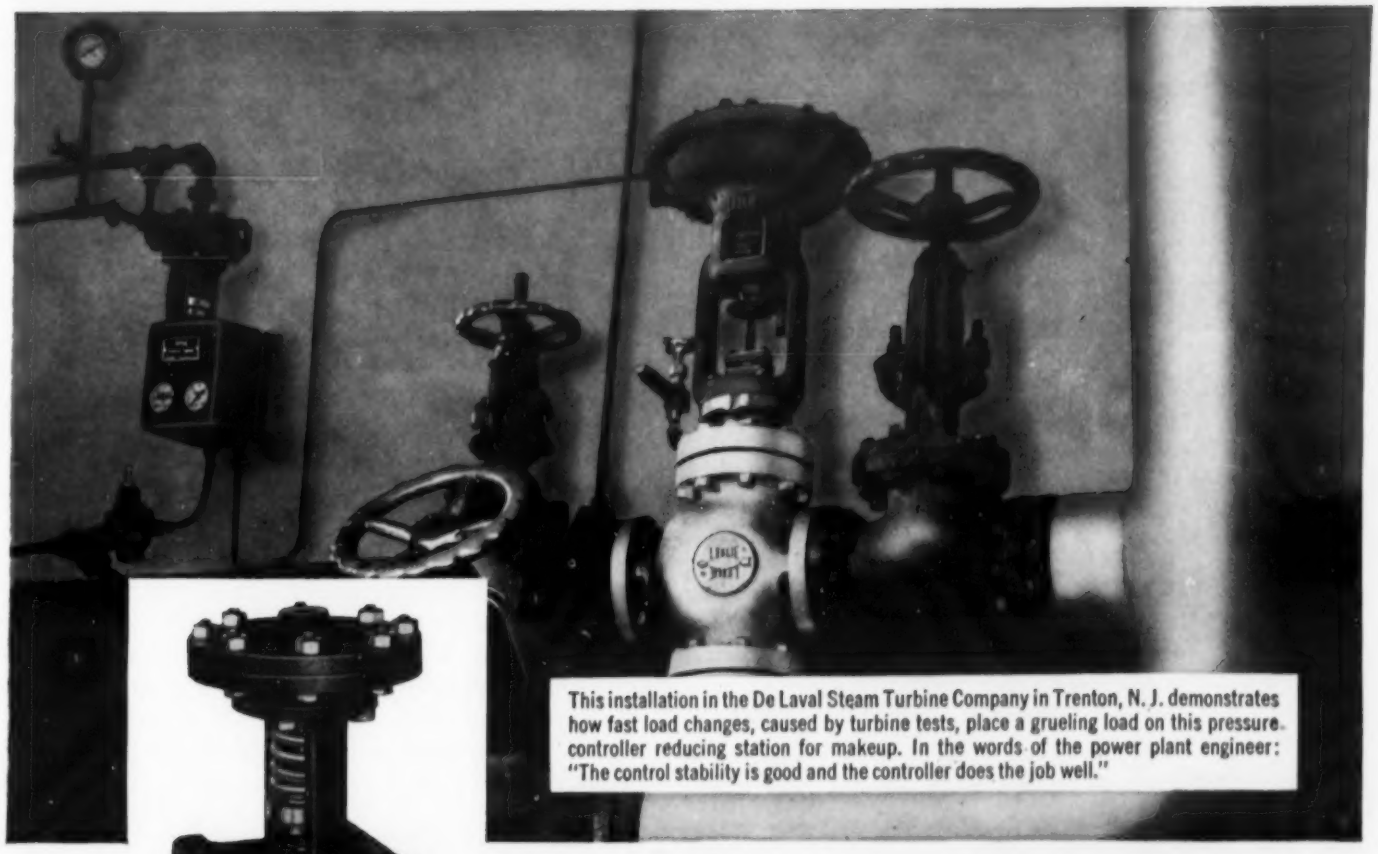
make in one pour

If possible, block foundations should be constructed in one pour. If this is not possible, proper keyways, with reinforcing, are required to assure crack-free conditions.

The center of gravity of the entire diesel generating unit set plus its foundation should coincide with centerline of the bearing area or base slab. This can be accomplished by computing the axis of gravity for the machine together with the upper foundation portion. Then, the axis can be located in the middle of the bottom slab.

Entire foundation bearing surface area should be on the same elevation. Steps, or so-called cascades, are very undesirable — not only because excessive settlement can occur under one foundation portion, but also because dynamic computation becomes much more indeterminate.

Foundation base slab should have a minimum depth of approximately 2 feet or more in most cases. In some cases, this thickness can be reduced. It is not advisable to anchor the foundation only 4 or 6 inches in soil (as has occasionally been done). Greater depth provides much more satisfactory anchorage for the foundation mass in soil. If piling is used, at least some piles at the foundation ends need to have reinforcing prolonged into the foundation block. ♦ ♦



This installation in the De Laval Steam Turbine Company in Trenton, N. J. demonstrates how fast load changes, caused by turbine tests, place a grueling load on this pressure controller reducing station for makeup. In the words of the power plant engineer: "The control stability is good and the controller does the job well."

Leslie Pressure Pilot

*not directly related to process variables but resulting from pipeline friction and turbulence.

Send for Bulletin 5303 that gives complete technical data and typical application sketches for the Leslie Pressure Control Pilot.

Narrow Band Pressure Control *with Stability*

Wide band stability and narrow band proportional control are uniquely combined in the Leslie Control Pilot without need for extra mechanisms to correct for over-sensitivity.

While the pilot responds to small, *definite* pressure changes, it "sorts out" and "ignores" the small, spurious* disturbances common to most control systems since it does not follow nor magnify these disturbances, cycling and hunting are eliminated. It is ideal for systems with short lag factors.

NO COSTLY EXTRAS

The "designed-in" stability and high capacity of Leslie Pressure Control Pilots also eliminates costly "extras" . . . there is no need for automatic reset, valve positioners or filter-type air sets. You get stable, reliable control *without* fussy adjustments and with *ordinary* plant air or water for the operating medium.

MORE INFORMATION

Ask your Leslie engineer to give you the complete story of the exclusive features that make Leslie Controllers ideal for straight pressure control problems. He's listed in your classified directory under "valves" or "regulators". Send for bulletin described at left.

TRADE LESLIE MARK

REGULATORS AND CONTROLLERS

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requires no service—contacts never pit, burn or corrode.
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links water level with electrical controls; prevents failure of mechanical linkages.
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is made of 304 Stainless Steel for long, trouble-free service. Can also be made of special materials for extreme local conditions.
NO-SCALE FLOAT CHAMBER LINER
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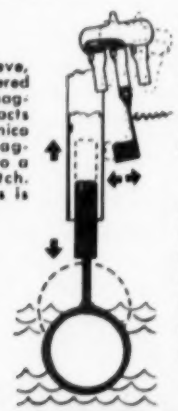

A magnetic sleeve, raised and lowered within a nonmagnetic tube, attracts or repels an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

"Blow-down" the float chamber once-a-shift; inspect the switches once a month—that's all you have to do to keep a Magnetrol in tip-top *safe shape*. It's made that way. The secret is all in the simple magnetic operating principle *as pioneered and perfected by Magnetrol.*

Standard Magnetrol Units are available for pressures to 600 psi and temperatures to 750°F., for single or multi-stage control with as many as three separate switching actions. Also special units for more extreme requirements. For full details, mail coupon.

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Gentlemen: Please send me Catalog Section III and full information on Magnetrol Boiler Water Level Controls. 10

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Address .....
City .....Zone..... State.....

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Remove irritating vapors

. . . starts on page 18

door air. In addition, the air does not have to be cooled and dehumidified, but is returned directly to the decal room.

The canister unit is 7½ feet long by 5 feet od. Adsorption chamber contains 1100 pounds of 50-minute Adsorbit activated coconut-shell carbon in a 6-inch cylindrical bed.

This 50-minute grade of activated charcoal was selected after tests made at the site. Activated charcoals are classified according to raw material, adsorptive capacity (activity), and mesh size. Many adsorption carbons are made from coconut shells for resultant hardness and high activity.

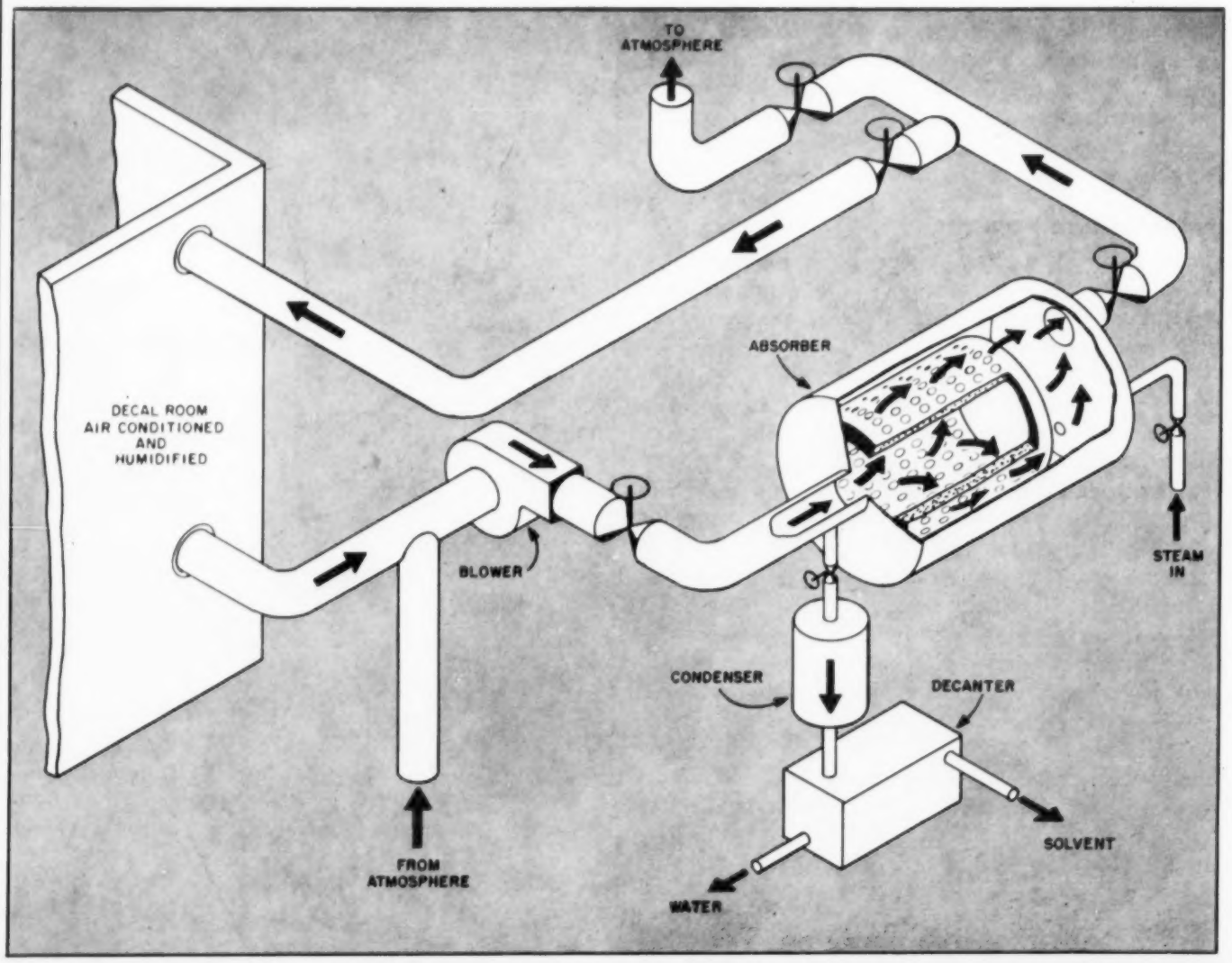
The best known test for adsorbent carbons is the U.S. Government chloropicrin test. This test gives the service life in minutes for a standard quantity of carbon under specific test conditions. Particle size is usually selected by keeping in mind the resistance to air flow, which should be kept at a minimum.

Activated charcoal is stable and does not react chemically with most liquids and gases. Even after being completely contaminated in severe service, it can be reactivated many times for further use.

Consolite has found it necessary to change the carbon only twice — at approximately 5-year intervals — since the installation was made 12 years ago. On-the-spot monthly regeneration keeps the unit operative. Regeneration is accomplished by passing steam through the carbon, thereby steam-distilling the solvents from the carbon. Steam and vapors are condensed and stored for re-use or disposal.

system proves mobility

This air cleaning system also proved its mobility when Consolite moved from its old location to a new site on the eastern outskirts of Fremont, Ohio. A separate building houses the Dandecal division in an area covering approximately 1000 sq ft. New building is designed especially for decal production and its insulation, air-conditioning, solvent recovery, and



Schematic of air purifying system shows simple hook-up required for on-the-spot regeneration of charcoal.

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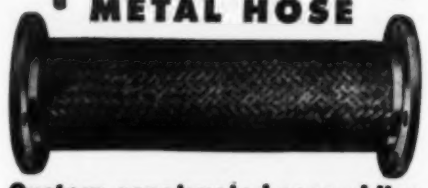
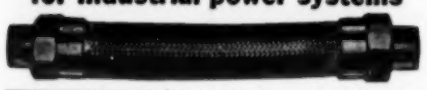
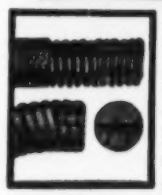


Custom constructed assemblies for industrial power systems





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There's still nothing simpler or more efficient in power line service than this Wilcox Self-Sealing Gasket which has served industry so well over the years. The U-shaped metal outer cover is packed with a resilient filling (usually rubber or asbestos). Pressure exerted on this elastic filling forces it into the cover, putting force against the adjacent flange surfaces. Thus, internal pressure that tends to blow ordinary gaskets makes the Wilcox Gasket tighter in the joint. Available with covers of copper, lead, tin, aluminum, monel, stainless steel, etc. in all sizes—standard or special.

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physical makeup are designed to provide ideal working conditions.

An area was designated for the processing equipment. A separate room held the solvent-recovery, air-purification system that was moved intact from the old plant in 1949.

Superintendent of operations, Zweily, states that it is an economical operation and that there has been almost no maintenance connected with the system. He points out that the air-purification unit had top priority in planning the new building.

Air moves laterally at about 5 mph through the press area, then between drying racks in the main racking room to the two-level intake ducts on the opposite wall. A third level duct (in the ceiling) helps remove lighter vapors.

Three levels are needed — the lowest about 6 inches off the floor, the next about 9 feet high, and the third near the 15-foot high ceiling. Specific gravities of the solvents vary. Lacquer fumes, for instance, are the heaviest and settle nearer the floor where they are taken off by the bottom ducts.

Air is controlled at 65% relative humidity. Dry-bulb temperature is maintained at 72 F while wet-bulb is at 64 F.

Air purification works in harmony with air conditioning. One-third of the conditioned air is recirculated through the activated charcoal. This amount is sufficient to keep operations moving smoothly. The equipment runs 24 hours a day, even though production is on a 5-day (7 am to 5 pm) schedule, because solvents evaporate from the decals while they are stored overnight in the drying racks.

Air-purification unit is steamed out one Friday each month at the close of the work day. Blowers are shut down, air dampers to and from the decal room are closed, and valves to the condenser are opened. Low-pressure steam is then introduced into the adsorber. Steam action causes activated charcoal to release the solvents that have accumulated during the month. Solvent vapors pass into a condenser and then to a decanter. Condensed solvents and water are separated — the water goes to a drain and solvents go to storage for disposal.

Recovered mixed solvents are of little value. The real value of the installation is in providing worker comfort and in assuring continued production.

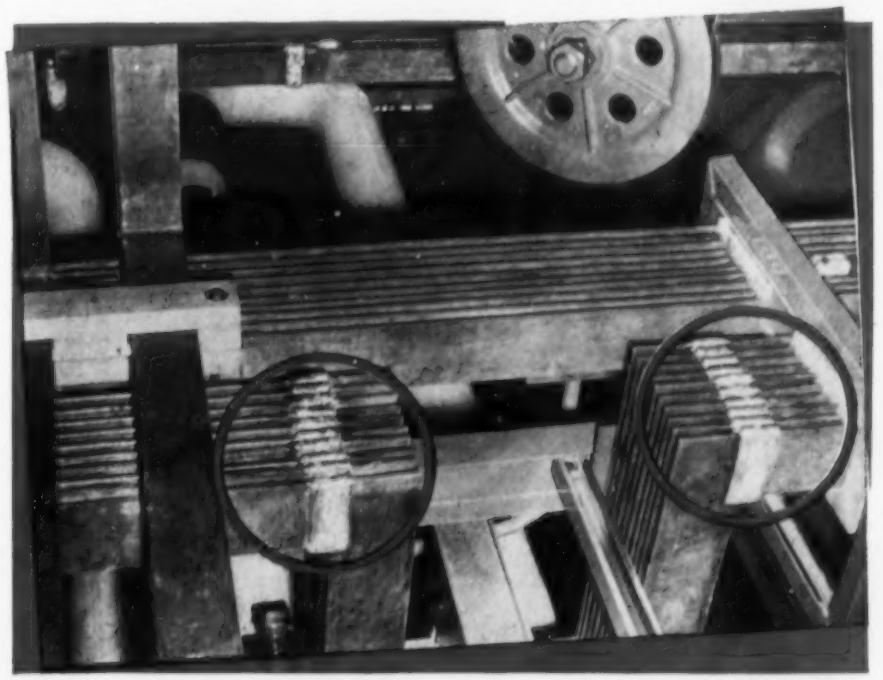
system saves operation

With this air-control system operative, the silk-screen processing of decals is no longer a comfort hazard. Humidity and temperature remain constant and insure proper register for printing decals. Without consistent conditions, and without odor removal, production would be impossible. Waste would be out of all proportion and the over-all operation too costly to continue.

Purified air inside the Dandecal plant provides the breath that keeps this business alive. ♦ ♦

GENERAL ELECTRIC endorses Contractor's use of CADWELD® electrical bus bar connections

HATFIELD ELECTRIC CO., INC., nationally-known electrical contractor recently completed an electrical bus bar installation for the GENERAL ELECTRIC COMPANY at Louisville, Kentucky. CADWELD ELECTRICAL CONNECTIONS were used on the ½ x 3 and ¼ x 4 bus bars that feed the GENERAL ELECTRIC plating tanks.



HATFIELD and GENERAL ELECTRIC were completely satisfied with their first experience with CADWELD on a multiple bus installation. Both companies have been using CADWELD for grounding connections for over five years.

Before figuring your next bus installation, investigate CADWELD.

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Engineering economics IV

. . . starts on page 20

the deduction the smaller the tax bill. As a general rule, a "fast write-off" for income tax purposes will favor a larger initial investment. Because of the time value of money, large tax savings during the early years of a project's useful life are more attractive than smaller savings spread out over a longer period.

Before any considerable capital outlay for new equipment is made to reduce operating costs, however, a tax consultant — either someone in your accounting office or a CPA who has had dealings with the Internal Revenue people — should review your figures. Operating costs are deductible, but part of the fixed charges on a capital outlay are not deductible.

In Example 1, for instance, the additional investment required for alternative B — Make Electricity — may not be justified when income taxes are taken into account unless the investment can be written off *for income tax purposes* in less than 15 years. The "legal" life of equipment — the allowable write-off period — depends upon rulings of the Internal Revenue Service.

where to get more information

We have now developed the necessary principles for a valid engineering economic study. A check list is shown below.

But the game of twisting figures is a fascinating one to many people. When you start to sell your ideas to your colleagues or to the front office, you will frequently find yourself confronted with a "What if . . . ?" or a "Yes, but . . . . " that may be difficult to answer. Two references to help you fight your battles are recommended.

For refinements, for additional ramifications, for problems and examples, and for many useful suggestions, it would be hard to find a better text than Eugene L. Grant, *Principles of Engineering Economy*, 3rd edition (New York: Ronald Press, 1950). For specific application of the principles to power generation problems, Skrotzki & Vopat, *Applied Energy Conversion* (New York: McGraw-Hill, 1945) is a good book. Both these textbooks have the unusual virtue of being easy to read. ♦♦

Have you read . . . .

what Julian E. Tobey, President of Appalachian Coals, Inc. has to say about the condition of our industrial boiler houses? He points out that management must change its outlook or lose money. Read Forum . . . .

see page 13.

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Stainless steel valve and seat. Sizes: ½" to 3". *Write for facts.*

Job after job, these Johnson Direct Acting Solenoid Valves are proving an ideal answer for service on steam lines. Their design removes the solenoid proper from the heat of the line, permits a leverage system with ample power to open against differential pressures up to 150 lbs. There are no pilot valves or auxiliary pistons, and construction is really heavy duty throughout. You will find their inherent simplicity and instant response will solve a lot of operating problems like no other valve can.

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Built to
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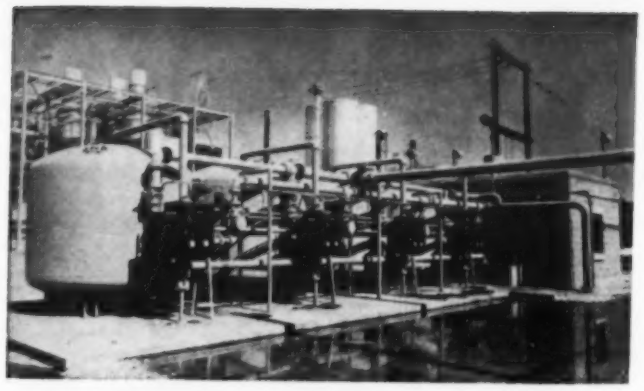

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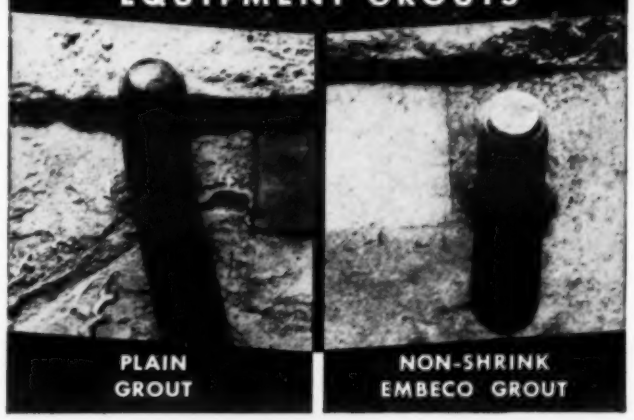

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A renaissance is needed

. . . starts on page 13

that the wastage of fuel in industrial and commercial plants through inefficient operation and poor repair ranges somewhere between 10 and 20%. Bringing the nation's boiler plants up to par in efficiency would effect a savings of between $100 and $200 million every year.

There always will be more old boilerhouses than new ones. If these older ones are not operated at acceptable standards by well-trained crews, the new boilerhouses will soon sag down to the same unfortunate fate.

There is a *strong vital force*, practically untapped, which *could* elevate the nation's industrial boilerhouses far above their present substandard levels. The vital force I speak of does not need to be named. In fact, it is difficult to name. (It is something like electricity. We know what it will do but we don't know exactly what it is. We could call it "X".

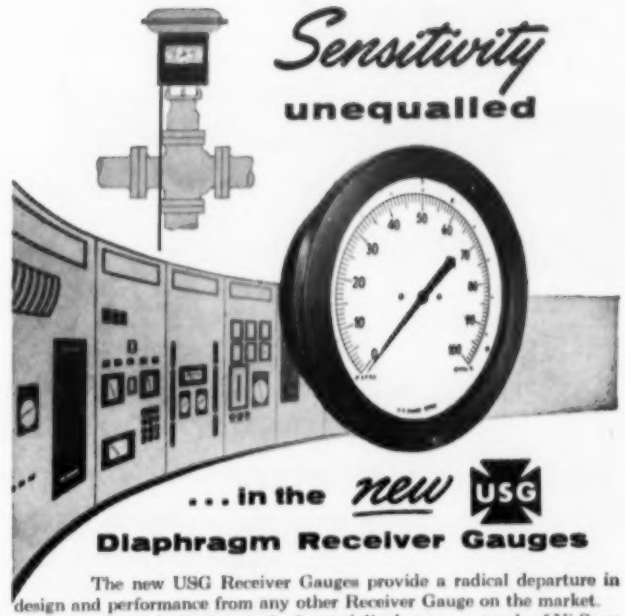
This strong vital force comes in a package made up of morale boosters . . . . including such things as pride of achievement, on-the-job skill, and desires for knowledge, recognition, appreciation, and good will. To release this vital force requires complete understanding and participation between management and boilerhouse personnel.

Good power plant operating men have a fierce pride in their hearts for their jobs and for the condition and performance of the equipment for which they are responsible. It's in their bones. Not so fortunate are the many in the substandard boilerhouses in our country, where pride lies latent because of frustration . . . . or lack of training . . . . or management's failure to recognize the importance of its power plant to its total production effort.

What to do? This question can be quickly resolved by a program as practical as a three-legged stool:

a) Clean up, paint up, and fix up boilerhouses.
b) Raise morale and skill of operating and maintenance personnel through training programs.
c) Sell to management the importance of its boilerhouse and the advantages of efficient operation based on better fuel utilization.

It should not be too difficult to carry out this three-pronged program to restore industrial power plants to their original design standards of efficiency . . . . to provide training programs to raise operating skill and morale . . . . and to convince management that their boilerhouse is a most vital component of production capability in furnishing steam and other power services. When an organization discovers from topside that it is easier and much more interesting to do the job *the right way*, nothing can stop the progress that will take all our boilerhouses out of the substandard category. ♦ ♦



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Standard USG Receiver Gauges provide a sensitivity of 1/10 of 1%, accuracy of ±¼ of 1% . . . both based on full scale readings, and are available in a choice of 4½", 6" or 8½" dials.

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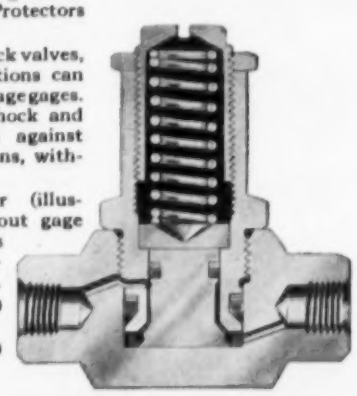
PROTECT your expensive gages from damage with Republic Gage Protectors and Pressure Snubbers.

Fluid hammer, chattering check valves, and severe pressure fluctuations can cause extreme shock, and damage gages. Pressure Snubbers absorb shock and permanently protect gages against damage from wild fluctuations, without affecting accuracy.

Adjustable Gage Protector (illustrated) automatically cuts out gage when system pressure rises above gage range, and reopens when pressure drops. Two types—ranges 15 to 5000 psi; 3 to 50 psi.

Working pressures to 10,000 psi.



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For your preventive maintenance program, you need the best possible protection at the lowest possible cost. Since 1941, TAPECOAT has proved its superiority in combating corrosion. This quality coal tar coating in handy tape form resists the corrosive hazards around power plants, coal hoppers, conveyors, etc. It's self-bonding—easy to apply with use of a torch. No skilled help needed. And it's low in cost considering its quality and continuing protection. Comes in rolls of 2", 3", 4", 6", 18" and 24" widths.

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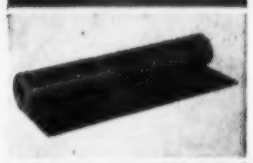

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Manufacturers of mechanical packings, industrial and boiler gaskets, steel rule dies, flexible packing hooks

Circle 116 on READ-N-CIRCLE card for more data

Reduced-voltage starters

. . . starts on page 22

rush is to be limited to increments of 40 amps.

Solution: With a motor having an inrush current of 150 amps and a starting torque load of 30 lb-ft, it is impossible to limit inrush to 40-amp increments with a two-step resistance starter or with an autotransformer starter. To satisfy these requirements, a multipoint resistance-type starter should be used. To limit increments as specified, motor starting torque will be reduced to where it will not accelerate the load on the first few steps. This is quite common. Frequently, a multipoint starter completes its cycle and applies full voltage to the motor before it is able to accelerate the load. This causes no harm and does satisfy the incremental inrush problem.

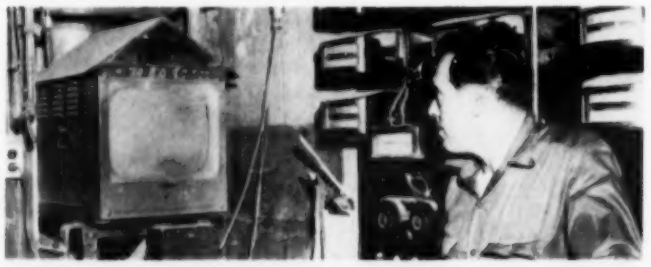
For applications demanding more stringent requirements than those mentioned—such as unusually high starting torque with low inrush current, or where limited variable speed is needed—a wound-rotor motor should be considered.

Effects of motor starting on system voltage can be serious. Severe voltage dips can cause lamp flicker, processing irregularities, and even system failure if voltage dip is sufficient. Check your starters now to eliminate these possibilities. ♦ ♦

Closed TV Saves $10,000

A $4000 investment in closed circuit television enables a zinc oxide product manufacturer to realize an estimated annual savings of $10,000.

Billed by the electric power company on a demand charge basis, the manufacturer had to pay a monthly bill based on the peak load used in that period, even if the peak lasted for just an instant.



Now, the company uses a small 5-lb General Precision Laboratories TV camera to monitor the electric company meter. Some 500-feet away in the plant control room, a plant engineer watches the meter reading on the TV screen. This enables plant engineer to make necessary load adjustments by switching electric furnaces to keep peak loads from exceeding certain limits. ♦ ♦

For Man-Cooling!

Coppus Airplane Type Heat Killer® **cools large areas — restores efficiency**

HEAT KILLER on the job in drop forge plant.

Steel mills, drop forge plants, foundries and other plants with hot working conditions find this Coppus Heat Killer increases worker efficiency . . . at reasonable cost. *A single fan cools large areas.*

Other types also available for cooling furnaces, electrical equipment, for driving out gases, drying out products, drawing out fumes. Write now for detailed information. COPPUS ENGINEERING CORPORATION, 185 PARK AVENUE, WORCESTER 2, MASSACHUSETTS.

ANOTHER COPPUS "BLUE RIBBON" PRODUCT

Circle 100 on READ-N-CIRCLE card for more data

Need sales or service information on products advertised in this issue? Need it fast? Use the *Locator* on page 53.

"Isn't that outdoor barbeque of yours finished, Al?"

handy guide

. . . to advertised products

AIR CLEANING EQUIPMENT

Control that flyash!
Read page 11 and circle number 132
THE AEROTEC CORP. Experience plus advanced design of mechanical and electrostatic dust collectors make Aerotec dust collection specialists. Write for details.

Make your air come clean!
Read page 5 and circle number 149
THE NORTHERN BLOWER CO. Let Norblo engineered dust collection systems solve your dust or fume problems. Clean air pays dividends in health, comfort, protection.

AIR CONDITIONING, HEATING, VENTILATING

Roof ventilators better 3 ways
Read page 12 and circle number 129
HARTZELL PROPELLER FAN CO. Gain high efficiency, low initial cost, minimum maintenance. Write for Bulletin A-112A.

For efficient man-cooling
Read page 48 and circle number 100
COPPUS ENGINEERING CORP. Airplane-type Heat Killer cools large areas, cures hot working conditions. Write for details of how Heat Killer increases worker efficiency at reasonable cost.

Reduce air-conditioning costs
Read page 51 and circle number 141
RUPPRIGHT ROTARY ROOF COOLER. Here's an economical way to cool your building. Easily installed on any roof.

BOILERS AND BOILER ACCESSORIES

Package steam generators save 3 ways
Read page 24 and circle number 130
FOSTER WHEELER CORP. Save time, space, maintenance with package steam generators. Send for Bulletin PG-55-3 to get the complete story.

Installing a new boiler?
Read page 38 and circle number 105
THE JAMES LEFFEL & CO. Bulletin 236 gives details on boilers for oil, gas, or coal firing. Mail coupon for your free copy.

BUILDING CONSTRUCTION, MATERIALS

Safe, strong welded grating
Read page 34 and circle number 119
STANDARD STEEL SPRING DIV., ROCKWELL SPRING & AXLE CO. Hexagonal cross bars give safe, long-wearing steel flooring. Write for complete details.

CORROSION CONTROL

Control enclosures and panels
Read page 37 and circle number 113
THE KIRK & BLUM MFG. CO. Panels fabricated to exacting specifications. Ask for newest K&B booklet on electrical enclosures.

Coal tar coating in tape form
Read page 48 and circle number 127
THE TAPECOAT CO. Write for information and prices on this useful tape.

ELECTRIC DISTRIBUTION

Sensitive circuit protection
Read page 8 and circle number 108
I-T-E CIRCUIT BREAKER CO., SWITCHGEAR DIV. Dual magnetic overcurrent trip device limits temporary overcurrents, trips instantaneously on high-magnitude fault currents.

Dry-type power transformers
Read page 23 and circle number 102
ACME ELECTRIC CORP. Dry-type Class H insulated transformers from 3 kva to 500 kva. Standard voltages to 600 volts.

Transformer—heart of a substation
Read page 31 and circle number 103
SORGEL ELECTRIC CO. Transformers in 100 to 3000 kva either dry-type or askarel-cooled are quiet, efficient at all loads.

Electric bus bar connections
Read page 45 and circle number 137
ERICO PRODUCTS, INC. General Electric Co. plant in Louisville endorses use of Cadweld on new multiple bus installation.

ELECTRIC UTILIZATION

Solve 3 spot heating problems
Read page 52 and circle number 107
EDWIN L. WIEGAND CO. Chromalox electric cartridge heaters solve flexing, moisture, abrasion problems. Send for free bulletin.

FUELS AND FIRING EQUIPMENT

Best source of stable, low-cost power
Read page 10 and circle number 139
BALTIMORE & OHIO RAILROAD. Coal fields served by B&O hold usable reserves of billions of tons of power-packed bituminous.

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THE ENGINEER CO. Enco automatic oil heating and pumping systems are designed, assembled, checked, and tested before shipment. Free bulletins available.

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CHESAPEAKE AND OHIO RAILWAY. For dependable deliveries of top quality coals, call the C&O representative.

(more handy guide on page 50)

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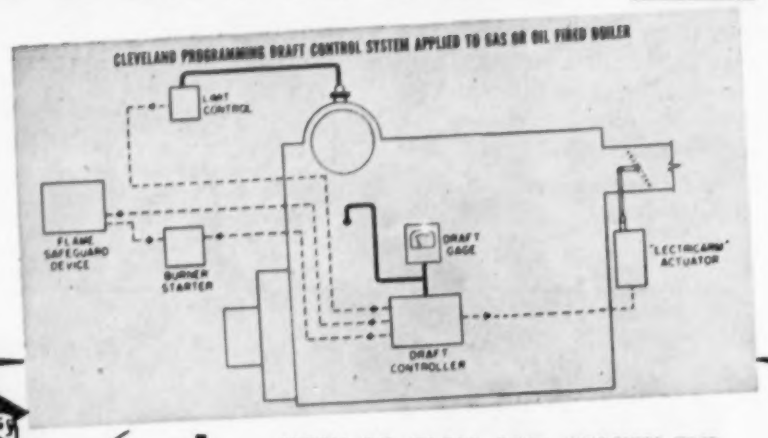

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AIR SAFETY SWITCHES
PANEL CONTROL CABINETS

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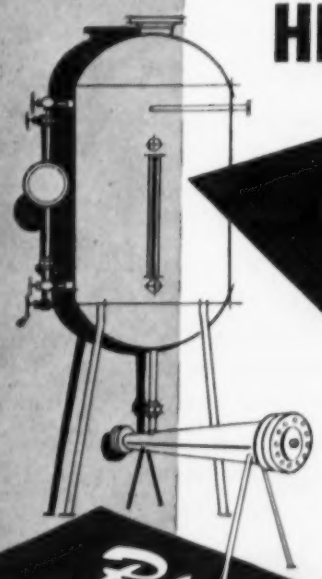
HENSZEY

Flash Tank



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• FULL HEAT RECOVERY

Blowdown

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Watertown, Wisconsin
Power Plant Division

Also Manufacturers of: Multiple Effect and Single Effect Evaporators and Tube Preheaters

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handy guide

. . . starts on page 49

Automatic fuel burner
Read page 51 and circle number 151
PEABODY ENGINEERING CORP. Investigate "premium safety" operating features in Peabody burners. Write for details.

HEAT EXCHANGERS

Aftercooler dries, cools compressed air
Read page 33 and circle number 106
NIAGARA BLOWER CO. Aero aftercooler cools compressed air or gas, condenses moisture.

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Read page 32 and circle number 135
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How to plan control system
Read page 50 and circle number 101
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Keep turbine performance efficient
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Barrel-type boiler feed pump data
Read page 39 and circle number 138
De Laval Steam Turbine Co. Bulletin 1506 describes barrel-type boiler feed pumps.

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Colored insulation protects, beautifies
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Reduce trap maintenance costs
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Armstrong Machine Works. Standardization of steam trap installation permits standardized hookups, quick parts replacement.

Cut filter downtime
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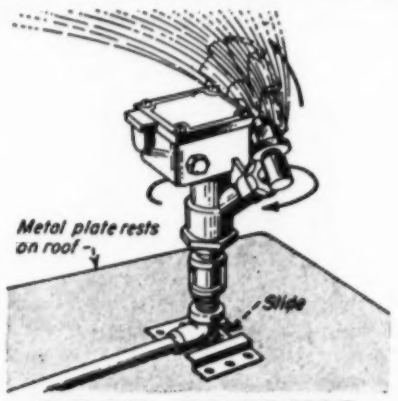

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Best Way to Reduce Air Conditioning Costs

Everyone knows how the sun, beating down on the roof of a building, descends into the interior. Even with insulation, this imposes a big load on air conditioning.
Roof cooling is the answer. It can be used on any roof to keep the building cooler and save air conditioning costs. Best equipment for the job is Ruppright's Rotary Roof Cooler. Easily installed, it produces a thin film of water on the roof. This film evaporates but is continuously renewed by the slowly-rotating cooler making the roof cooler than the air.

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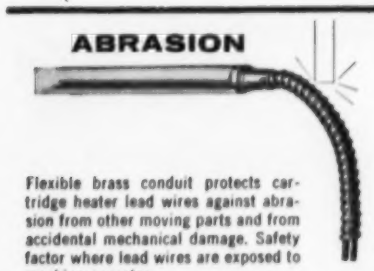
MOISTURE

Moisture-resistant flexible brass conduit protects lead wires of cartridge heaters operating in presence of steam, water, oil and vapors. Also offers added protection from flexing, vibration and mechanical damage.

ABRASION



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1000	G.E.	12000	600
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250	G.E.	440	250
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200	Westg.	2300/4000	250/275
200	Ridgeway	2400	250
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150	A.C.	2300	275
150	Westg.	2300	125/250
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100	G.E.	2300	250
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100	Elec.-Mch	440	125
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HP	Make	Type	Speed
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750	*Westg.	CS	900
500	*Al-Ch.	ARW	3500
500	Gen. Elec.	K-6345	1200
500	G.E.	KT-424	450
350	*G.E.	KT-559A	1800
250	West CS-8120S	TEFC	1800
250	B.E. (2)	KT-559	1800
250	*L-Allis	OEX-148	720
250	*G.E.	IK	600
250	G.E.	IK-17A	600
250	West.	CS-14	514
200	G.E.	FT-549Y	3600

Slip Ring MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2200 volts or higher)

HP	Make	Type	Speed
2500	*G.E.	MT	257
1200	*Al-Ch	ANT	1800
600	*G.E.	MT	450
500	G.E.	M-6345	1200
300	G.E.	IM-178	600
250	*G.E.	IM	720
200	G.E.	IM	600
200	Westg. (2)	CW	514
200	*Westg.	CW-905-A	514
150	Cr-Wh.	50-R	1800

Synchronous MOTORS

3 Phase, 60 Cycle, 220 or 440 Volts (*2300 volts or higher)

HP	Make	Type	P.F.	Speed
1420	Westg.	HG	.7	900
400	Westg.	HG	1.0	900
300	G.E.	ATI	.8	720
300	*Ideal	SMM	.8	257
275	*G.E. (2)	ATI	1.0	450
250	Al.-Ch.	SYN	1.0	1200
225	G.E.	TS-6244	1.0	300
225	Elec. Mchy.		1.0	360
190	Elec. Mchy.		1.0	720

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AEROTEC CORP. .....Page 11

See Thermix Corp.

ARMSTRONG MACHINE WORKS .....Pages 9-41

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BALTIMORE & OHIO RAILROAD ....Page 10

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DETROIT 26, MICH.: C. E. Schroeder, 610 Lafayette Bldg., 154 W. Lafayette Blvd.

BUFFALO METER CO. .....Page 36

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CINCINNATI 37, OHIO: Chapman Engineering Sales Co., 1717 Section Rd., ELmhurst 3140.
CLEVELAND 13, OHIO: Illes Power Control Co., 22700 Shore Center Dr., REdwood 2-9300.
DES MOINES 9, IOWA: Deco Engrg. Products, 1112 Locust St., 8-5721.
DETROIT 12, MICH.: Metrol Co., 7145 E. Davison, TWinbrook 3-6300.
INDIANAPOLIS 4, IND.: DeHaven Engineering Co., 1444 Consolidated Bldg., 115 North Penn. St., MElrose 2-2563.
KANSAS CITY 14, MO.: Economy Equipment Co., 7341 B'way, JAckson 3-1010.
KNOXVILLE 5, TENN.: Leinart Engineering Co., 412 E. Fifth Ave., 5-0363.
MEMPHIS 5, TENN.: C. J. Gaskell Co., Inc., 216 N. Lauderdale Ave., 8-2241.
MILWAUKEE 4, WIS.: Geo. H. Fredricks & Co., Inc., 4385 N. Green Bay Ave., COncord 4-1070.
MINNEAPOLIS 2, MINN.: Berry Ervin Engineering Co., Builders Exchange Bldg., FEderal 2-8861.
ST. LOUIS 8, MO.: Economy Equipment Co., 4526 Olive St., FOrest 7-5328.

CHAPMAN VALVE MFG. CO. .....Page 25

INDIAN ORCHARD, MASS.: (Home Office)

CHESAPEAKE & OHIO RAILWAY ...Page 35

DETROIT 2, MICH.: W. F. Pye, Fuel Service Engineer, C & O, 7-150 General Motors Bldg.

CHICAGO-WILCOX MFG. CO. ....Page 45

CHICAGO 19, ILL.: (Home Office) 7725 S. Avalon Ave.

CLEVELAND FUEL EQUIPMENT CO. .....Page 50

CLEVELAND 9, OHIO: (Home Office) 1111 Brookpark Rd.

COBRA METAL HOSE, DIV. OF DK MFG. CO. .....Page 45

CHICAGO, ILL.: Power Transmission Equipment Co., 1245 West Fulton St.
CLEVELAND, OHIO: Koehler Rubber & Supply Co., 3865 Carnegie Ave.

COPPUS ENGINEERING CORP. ....Page 48

WORCESTER, MASS.: (Home Office) 262 Park Ave.

DEARBORN CHEMICAL CO. .....Page 3

CHICAGO 43, ILL.: A. W. Johnson, 1840 W. 105th St.
CHICAGO 54, ILL.: E. W. Houseknecht, A. R. Tanis, Dearborn Chemical Co., Merchandise Mart Plaza.
CINCINNATI 8, OHIO: D. D. Powers, 1128 Paxton Ave.
CLEVELAND 28, OHIO: J. W. Fisher, 17020 Glendale Ave.
DETROIT 35, MICH.: J. H. Alm, T. W. Mack, 18954 James Couzens Hwy.
EARLVILLE, ILL.: J. P. Byrnes, R. R. #3.
EAST LANSING, MICH.: T. J. Weisbruch, 648 Gunson St.
EASTLAKE, OHIO: J. R. Fletcher, 281 Willowick Dr.
FLORISSANT, MO.: C. D. Schroeder, 435 Larry Dr.
GREEN BAY, WIS.: R. H. Fritschel, 920 Meacham.
HILLSIDE, ILL.: T. Zaggy, 4511 Jackson Blvd.
INDIANAPOLIS 3, IND.: G. B. Thurston, 4101 E. Naomi St.
JASPER, IND.: H. Beyersdorf, Jr., 115 East Fourth St.
KANSAS CITY, MO.: E. W. Roberts, 5827 Wabash.
MARIETTA 7, OHIO: J. A. Crenner, 519 Adams St.
MARION, OHIO: R. J. Maginn, 140 Clover Ave.
MINNEAPOLIS 24, MINN.: R. T. Moran, 5409 Mirror Lakes Dr.
NASHVILLE 4, TENN.: G. E. MacLean, 3503 Rainbow Place.
ROCK ISLAND, ILL.: R. O. Benson, 4000 - 22nd Ave.

DE LAVAL STEAM TURBINE CO. ....Page 39

TRENTON 2, N. J.: (Home Office) 857 Nottingham Way.

ENGINEER CO. .....Page 32

CHICAGO 4, ILL.: George J. Zanke, 53 W. Jackson Blvd., HArrison 7-5848.
CINCINNATI, OHIO: Fred Ellman, 1013 Fed. Reserve Bank Bldg.
CLEVELAND, OHIO: Ashmead-Danks Co., 316 Marion Bldg., MAin 1-6192.
DETROIT 2, MICH.: Agren Ascher Co., 5-121 Gen. Motors Bldg.
KANSAS CITY 11, MO.: Hughes Machinery Co., 4212 Main St., VAlentine 1-7021.
MEMPHIS, TENN.: Power Equipment Co., 1356 Madison Ave.
ST. LOUIS 8, MO.: Rhodes Equip. Co., 4485 Olive St.
ST. PAUL 1, MINN.: Commonwealth Electric Co., 417 Broadway, CApitol 4-1836.

ERICO PRODUCTS CO. .....Page 45

CLEVELAND, OHIO: (Home Office) 2070 E. 61st Place.

FLEXROCK CO. .....Page 26

PHILADELPHIA 1, PA.: (Home Office) 3609 Filbert St.

BENJAMIN FOSTER CO. .....Page 49

PHILADELPHIA, PA.: (Home Office) 4635 W. Girard Ave.

FOSTER WHEELER CORP. .....Page 24

CHICAGO 3, ILL.: 105 West Adams St.
CLEVELAND 14, OHIO: Leader Bldg.
DETROIT 26, MICH.: Michigan Bldg.
KANSAS CITY 5, MO.: Dwight Bldg.

GRAPHIC SYSTEMS INC. .....Page 37

NEW YORK, N. Y.: (Home Office) 55 W. 42nd St.

HARTZELL PROPELLER FAN CO. ....Page 12

CHATTANOOGA, TENN.: 2001 Broad St., 5-3407.
CHICAGO 40, ILL.: 1249 Devon Ave., BRiargate 4-2620.
CINCINNATI 7, OHIO: 1836 Dana Ave., MElrose 12945.
CLEVELAND 13, OHIO: 2012 W. 25th St. SUperior 1-5022.
DAYTON 9, OHIO: 120 Stonemill Rd., MIchigan 8032.
DETROIT 2, MICH.: 807 New Center Bldg., TRinity 5-2045.
INDIANAPOLIS 8, IND.: Box 5002, Station A, MElrose 6-1478.
LOUISVILLE 1, KY.: P. O. Box 64, GLendale 8-2709.
MILWAUKEE 4, WIS.: 1225 W. Mitchell St., MItchell 5-1370.
MINNEAPOLIS 3, MINN.: 620 Plymouth Bldg., FEderal 2-0528.
NORTH LITTLE ROCK, ARK.: 109 S. Main St.
ROCK ISLAND, ILL.: 3209-35th Ave., 6-7519.
ST. LOUIS 19, MO.: P. O. Box 4, Webster Groves Sta. WOodland 1-7816.
TOLEDO 10, OHIO: 2909 Detroit Ave., CHerry 4-5431.

HENSZEY CO. .....Page 50

CHICAGO 7, ILL.: Himelblau, Byfield & Co., 1217 W. Washington.
CINCINNATI, OHIO: Carl G. Freudenberg, 5905 Red Bank Rd.
DES MOINES 12, IOWA: Elwood C. Giberson, 4110 Greenwood Dr.
DETROIT 27, MICH.: Herman C. Howell, 15720 Mark Twain Ave.
FERN CREEK, KY.: J. Zimmermann, P. O. Box 66.
GRAND RAPIDS 7, MICH.: Kress Engineering & Sales Co., 1342 Burton St., S. E.
INDIANAPOLIS 20, IND.: Young-Streeter Co., 6220 College Ave.
KALAMAZOO, MICH.: Max L. Young, Box 629.
KANSAS CITY 8, MO.: Fred N. Schadd, 3252 Roanoke Rd.
MEMPHIS 5, TENN.: C. J. Gaskell Co., 216 N. Lauderdale Ave.
PETOSKEY, MICH.: Jobber, Wm. Dunstan Supply Co., 555 Porter St.
ST. PAUL 1, MINN.: Commonwealth Electric Co., 417 Broadway.
WILLOUGHBY, OHIO: R. D. Murphy, 4815 Waldamere Ave.

HUNGERFORD & TERRY, INC. .....Page 47

CHICAGO 4, ILL.: Ross Engineering, 224 S. Michigan Ave., WEbster 9-4721.
CLEVELAND 3, OHIO: R. D. Murphy, 6801 Euclid Ave., HEnderson 2-1900.
DETROIT 27, MICH.: Clifford B. Armstrong, Jr., 16817 Grand River Ave., VErmont 8-4248.
INDIANAPOLIS 20, IND.: H. C. Ohge, 5324 Primrose Ave., BRoadway 7316.
KANSAS CITY 9, MO.: Parker & Foster, 3519 Troost Ave., JEfferson 4490.
LOUISVILLE 2, KY.: Allan K. Cook Co., 604 W. Main St., WAbash 1269.
MEMPHIS 5, TENN.: C. J. Gaskell Co., 216 N. Lauderdale Ave., MEmphis 8-2241.
ST. LOUIS 10, MO.: Hudson Chem. Co., 4010 Chouteau Ave., JEfferson 1-7843.

IDEAL INDUSTRIES, INC. .....Page 36

SYCAMORE, ILL.: (Home Office) 1006 Park Ave.

I-T-E CIRCUIT BREAKER CO., SWITCHGEAR DIV. .....Page 8

CHICAGO 3, ILL.: Bankers Building, Room 1719, 105 West Adams St.
CINCINNATI 27, OHIO: 6953 Thorndike Road.
CLEVELAND 15, OHIO: 631 Hanna Bldg., 14th Street and Euclid Ave.
DETROIT 26, MICH.: Guardian Bldg., Room 1512, 500 Griswold St.
INDIANAPOLIS 4, IND.: Geo. A. Wright, 609 Roosevelt Bldg.
KANSAS CITY, 5, MO.: Room 920, Dwight Bldg.
MILWAUKEE, WIS.: Room 405, 210 Michigan Ave.
MINNEAPOLIS 3, MINN.: 326 Plymouth Bldg., Hennepin and Sixth St.
ST. LOUIS 5, MO.: 7 North Brentwood Blvd.

JOHNSON CORP. .....Page 46

THREE RIVERS, MICH.: (Home Office) 807 Wood St.
CHICAGO 6, ILL.: Barrett-Christie Co., 118 N. Clinton St.
CINCINNATI 36, OHIO: Graeme Robertson, 8400 Wicklow Ave.
CLEVELAND 14, OHIO: Tomlinson Steam Specialty Co., 1599 St. Clair Ave.
DES MOINES 9, IOWA: Fred E. Triggs, 200 Plymouth Bldg.
DETROIT 3, MICH.: Merlo Steam Equipment, 1506 E. State Fair.
DULUTH 2, MINN.: Williams-Swanson Co., 208 Builders Exchange Bldg.
GRAND RAPIDS 2, MICH.: Hayden Supply Co., 41 Market Ave., S. W.
INDIANAPOLIS 9, IND.: Indianapolis Belting & Supply, 34 S. Capitol Ave.
KANSAS CITY 11, MO.: Hughes Machinery Co., 4212 Main St.
KNOXVILLE 17, TENN.: Dickey Engineering Co., 3009 Central Ave., N. W.
LOUISVILLE 2, KY.: Graft-Pelle Co., 309 W. Main St.
MEMPHIS 4, TENN.: Power Equipment Co., 1352 Madison Ave.
MILWAUKEE 4, WIS.: The Williams Engineering Co., 331 W. National Ave.
MINNEAPOLIS, MINN.: Blesi-Evans Co., 2803 Riverside Ave.
ST. LOUIS, MO.: O'Brien Equipment Co., 2832 Olive St.
SOUTH BEND 23, IND.: Smith-Monroe Co., 1912 S. Main St.
WOOSTER, OHIO: Steam Economics Co., Rm. 6 Quinby Bldg.

THE KIRK & BLUM MFG. CO. .....Page 37

CHICAGO 30, ILL.: Ken Jenson, 5939 W. North Ave., NAtional 2-1535.
DETROIT 2, MICH.: June & Co., 505 New Center Bldg., TR 1-7450.

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the LOCATOR

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THE JAMES LEFFEL & CO. .....Page 38

SPRINGFIELD, OHIO: (Home Office) 426 East.

LESLIE CO. .....Page 43

APPLETON, MILWAUKEE, WIS.: Donald E. Riley & Co., Inc.
BIRMINGHAM, MICH.: George W. Murphy Co.
CHICAGO, ILL.: Instrument Associates.
CINCINNATI, OHIO: The A. A. Betts Co.
CLEVELAND, OHIO: W. M. Wilson Co.
DAVENPORT, IOWA: Saycon Inc.
DES MOINES, IOWA: W. W. Stuart.
FERN CREEK (LOUISVILLE), KY.: J. Zimmermann.
GRAND RAPIDS, MICH.: Robert W. Shedd.
INDIANAPOLIS, IND.: Young-Streeter Co.
KANSAS CITY, MO.: Mooney Engrg. Co., Inc.
KINGSPORT, CHATTANOOGA, TENN.: Abernathy-Thomas Engineering Co.
MEMPHIS, TENN.: Power Equipment Co.
MINNEAPOLIS, MINN.: Plant Equipment, Inc.
ST. LOUIS, MO.: Roger P. Kipp Co., Inc.
YOUNGSTOWN, OHIO: Brenner Industrial Sales & Supply Co.

MAGNETROL, INC. .....Page 44

CHICAGO 10, ILL.: Meters and Controls, 444 North LaSalle St., WHitehall 4-1448.
CLEVELAND 23, OHIO: Iles Power Control Co., 22700 Shore Center Dr., REdwood 2-9300.
CLINTON, IOWA: Meters and Controls, Room 208, Johannes Bldg., CHapel 3-2033.
DAVENPORT, IOWA: Deco Engineering Products, 320 Western Ave., 7-6123.
DES MOINES 9, IOWA: Deco Engineering Products, 1112 Locust St., 8-5721.
DETROIT 7, MICH.: Smith Instrument & Equipment Co., 1900 East Jefferson Ave., LOrain 7-3550.
GRAND RAPIDS 7, MICH.: Kress Engineering & Sales Co., 1342 Burton Ave., S. E., GLendale 2-9176.
INDIANAPOLIS 5, IND.: C. M. Buck, 2927 Central Ave., WAlnut 5-1832.
KANSAS CITY, MO.: Economy Equipment Co., 7341 Broadway, JAckson 3-1010.
MEMPHIS 5, TENN.: C. J. Gaskell Co., Inc., 216 North Lauderdale Ave., 8-2241.
MINNEAPOLIS 9, MINN.: Engineered Sales, 314 West 38th St., LOcust 0696.
MUSKEGON, MICH.: Smith Instrument & Equipment Co., 1466 Bearsley.
RIPON, WIS.: Yates Equipment & Supply Co., P. O. Box 331, BLack 600.
ST. LOUIS, MO.: Economy Equipment Co., 4526 Olive St., FOrest 5328.
TOLEDO 9, OHIO: Mason Equipment Co., 1601 Broadway, FUlton 4269.
CINCINNATI 8, OHIO: The Abbott Co., 3437 Michigan Ave., EA 1-2349.
COLUMBUS, OHIO: The Abbott Co., 1342 Highland St., AX 9-4244.
LOUISVILLE, KY.: The Abbott Co., 366 Francis St., JUniper 4-4713.

MANHATTAN RUBBER DIV., RAYBESTOS-MANHATTAN, INC. Page 6-7

CHICAGO, ILL. CLEVELAND, OHIO
DETROIT, MICH. ST. LOUIS, MO.
MINNEAPOLIS, MINN.

MASTER BUILDERS CO. .....Page 47

CLEVELAND 3, OHIO: (Home Office) 7016 Euclid Ave.

JAS. A. MURPHY & CO., INC. .....Page 46

HAMILTON, OHIO: (Home Office) Box 614.

NEW YORK & NEW JERSEY LUBRICANT CO. .....Page 34

CHICAGO, ILL.: N. Y. & N. J. Lubricant Co., 846 West Harrison Street.
CHICAGO 36, ILL.: J. N. Seng, 6151 S. Honore St.
CLEVELAND HEIGHTS 18, OHIO: G. W. Brenholts, 2328 Lamberton Road.
DETROIT, MICH.: A. A. Vogler, 4150 Haverhill Ave.
FORISTELL, MO.: A. H. Harlan, RFD 1, Box 191.
GREENSBURG, PA.: R. A. Henkel, 303 Center Ave.
LANETT, ALA.: A. M. Cowan, Box 563.
SOUTH HILLS, COVINGTON, KY.: S. F. Britton, 1503 Henry Clay Ave.

NIAGARA BLOWER CO. .....Page 33

MILWAUKEE 4, WIS.: Geo. H. Fredricks & Co., Inc., 4385 N. Green Bay Ave., COncord 4-1070.

NORTH AMERICAN MOGUL PRODUCTS CO. .....Page 55

CLEVELAND 13, OHIO: (Home Office) Standard Bldg.

NORTHERN BLOWER CO. .....Page 5

CLEVELAND 2, OHIO: (Home Office) 6500 Barberton Ave.

PALMER THERMOMETERS, INC. ....Page 32

CHICAGO 30, ILL.: Becker Engineering & Supply Co., 6539 N. Minnehaha Ave., ROdney 3-3187.
CINCINNATI 3, OHIO: Plant Equipment Co., Union Terminal Bldg., PA 1-6183 or GR 1-1552.
CLEVELAND, OHIO: H. R. Bowers, 1585 West 117th St., ACademy 1-8442.
DETROIT 27, MICH.: Industrial Instrument Supply & Mfg. Co., 14222 Robson Ave., VErmont 8-5940.
INDIANAPOLIS 8, IND.: Paller Engineering Co., 3025 N. Illinois St., TAlbot 5444.
MEMPHIS 12, TENN.: Engineered Instrument Sales Co., 2717 Union Ave., 33-1275.
MILWAUKEE 17, WIS.: Charles D. Haven, Jr., 5477 North Lake Drive, WOodruff 2-5139.
ST. LOUIS 20, MO.: Carl F. Gast Co., 6110 Garesche Ave., EVergreen 3-0750.
ST. PAUL 4, MINN.: John L. Schmidt, 1879 University Ave., NEstor 6383.

PEABODY ENGINEERING CORP. ....Page 51

NEW YORK 16, N. Y.: (Home Office) 232 Madison Ave.

RANNEY METHOD WATER SUPPLIES, INC. .....Page 46

COLUMBUS 19, OHIO: (Home Office) 841 Alton Ave.

RAYBESTOS-MANHATTAN, INC. ..Pages 6-7

See Manhattan Rubber Division.

RELIANCE GAUGE COLUMN CO. ..Page 33

CHICAGO 4, ILL.: W. P. Nevins Company, 53 West Jackson Blvd.
CINCINNATI 37, OHIO: Chapman Engineering Sales Company, 1720 Section Road.
CLEVELAND 15, OHIO: The L. H. Waldrip Company, 3030 Euclid Ave.
DES MOINES 9, IOWA: Midwest Controls Company, 1010 Cherry St.
DETROIT 12, MICH.: Metrol Company, 7145 East Davison St.
INDIANAPOLIS 4, IND.: DeHaven Engineering Company, 1444 Consolidated Bldg., 115 N. Pennsylvania St.
KALAMAZOO, MICH.: Metrol Company, 420 West South St.
KANSAS CITY 12, MO.: Economy Equipment Company, 7341 Broadway.
MILWAUKEE 9, WIS.: George H. Fredricks & Company, 4385 North Green Bay Ave.
MINNEAPOLIS 12, MINN.: Bell & Eiss, Inc., Foshay Tower.
ST. LOUIS 8, MO.: Economy Equipment Company, 4526 Olive St.
TOLEDO 2, OHIO: Metrol Company, 2154 Madison Ave.

REPUBLIC MFG. CO. .....Page 47

CLEVELAND 11, OHIO: Frank Hribar, S. M. Republic Mfg. Co., 15655 Brookpark Rd. CLearwater 2-1800.
CHICAGO, ILL.: George H. Goecke, Windsor Wilson Apt. Hotel, 915 Wilson Ave.
KIRKWOOD 22, MO.: Tom G. Rankin, 533 E. Argonne Dr.

RHOPAC, INC. .....Page 48

SKOKIE, ILL.: (Home Office) 3424 Cleveland.

RONNINGEN-PETTER MFG. CO. ...Page 37

VICKSBURG, MICH.: (Home Office)

RUPPRIGHT'S ROTARY ROOF COOLER .....Page 51

LOS ANGELES 43, CALIF.: (Home Office) P.O. Box 43555.

FRED H. SCHAUB ENGINEERING CO. .Page 4

CHICAGO 11, ILL.: Albert Kral Co., 612 North Michigan Ave.
CINCINNATI 6, OHIO: Crawford Power Equipment Co., 2904 Woodburn Ave.
CLEVELAND 28, OHIO: Crawford Power Co., 4130 Lee Rd.
GRAND RAPIDS 7, MICH.: Kress Engineering & Sales Co., 1342 Burton St., SE.
GROSSE POINTE WOODS 36, MICH.: The J. H. Comins Co., 1713 Anita Ave.
INDIANAPOLIS 1, IND.: R. M. Cherry Co., 5017 E. Michigan Ave.
INDIANAPOLIS 19, IND.: Noah M. Simmons Co., 5341 English Ave.
KALAMAZOO, MICH.: Kress Engineering & Sales Co., P.O. Box 629.
KANSAS CITY 6, MO.: S. C. McCann Co., 210 West 10th St., Rm. 612.
KNOXVILLE, TENN.: Boiler Supply Co., 601 South Central.
LITTLE ROCK, Ark.: Mullins Engineering Co., 524 E. Markham.
MEMPHIS 3, TENN.: T. J. O'Brien Engr. Co., 668 South Main St.
NASHVILLE, TENN.: Boiler Supply Co., 490 Craighead St.
PEORIA, ILL.: Howard O. Sprogle, 1011 West Main St.
RIPON, WIS.: Yates Equipment & Supply Co., P.O. Box 331.
ST. LOUIS 17, MO.: E. P. Harder Associates, 1702 McCready Ave.
ST. PAUL 4, MINN.: The John Hawe Co., 293 North Snelling Ave.
TOLEDO 3, OHIO: The Shaw-Kendall Engr. Co., P.O. Box 1736, 120 South Superior St.
WATERLOO, IOWA: Floyd D. Hays, 825 Franklin St.
WILMETTE, ILL.: Fred Thompson, 1637 Spencer Ave.

SORGEL ELECTRIC CO. .....Page 31

ATLANTA, GA.: Osgood & Associates, P. O. Box 7383 - Station C. TRinity 5-7804.
BUFFALO 21, N. Y.: C. V. Stevens, 5495 Main St., PLaza 0300.
CHICAGO 41, ILL.: L. L. Weldy & Associates, 4201 W. Irving Park Rd., Spring 7-8575 and 7-8576
CLEVELAND 15, OHIO: Harvey E. Lakin, 3521 Euclid Ave., Endicott 1-6748.
COVINGTON, KY.: H. E. Bracke, 1053 Madison Ave., Hemlock 1-2299.
DAVENPORT, IOWA: Midwest Eqiupment Co. of Iowa, P. O. Box 532, 7-7074.
DES MOINES 14, IOWA: Midwest Equipment Co. of Iowa, 842 Fifth Ave., Cherry 3-1203.
DETROIT 35, MICH., Wm. H. Yeomans, 15926 West McNichols Rd., Vermont 8-1808.
GREENSBORO, N. C.: Max I. Miller, P. O. Box 2826, 3-7955.
INDIANAPOLIS 20, IND.: Kyle G. Herder, P. O. Box 5952, Clifford 5-1361.
KANSAS CITY 8, MO.: Fleming & Co., 3021 Main St., Plaza 3-0111 and 3-0112.
LOS ANGELES 23, CALIF.: H. D. Easterbrook, 1264 South Boyle Ave., ANgelus 9-9421.
MILWAUKEE 2, WIS.: L. L. Weldy & Associates, 833 E. Kilbourn Ave., Broadway 3-6761.
MINNEAPOLIS 15, MINN.: Electrical Jobbers Equipment Co., 619 Fourth Ave., South Federal 6-6321.
NEW YORK 36, N. Y.: Elmer Richards, 141 E. 44th St., Rm. 512, OXford 7-7920.
NORFOLK 3, VA.: W. A. Bristol Co., 8725 Commodore Dr., JUstice 9-6114.
OMAHA 2, NEB.: Midwest Equipment Co. of Omaha, 1614 Izard St., ATlantic 7600.
PHILADELPHIA 6, PA.: Clisby & Associates, 28 South Delaware Ave., WAlnut 2-2185.
PITTSBURGH 36, PA.: Wm. E. Wargo, 125 Green Drive, TUxedo 4-3977.
PORTLAND 9, ORE.: Fred W. Carlson & Assoc 935 Northwest 12th Ave., Rm. 133, CA 8-3798.
QUINCY 69, MASS.: Kenneth F. McIsaac, 11 Campbell St., PResident 3-7731.
ST. LOUIS 16, MO.: Charles H. Douglas, 4445 Gustine Ave., Flanders 1-1100.
SAN FRANCISCO 10, CALIF.: Campbell & George Co., 1601 Cortland Ave., MIssion 8-1236.
SEATTLE 9, WASH.: Fred W. Carlson, 1201 Dexter Ave., ELliott 6630.
SHREVEPORT, LA.: Jack D. Clark, 2850 Bibb St., 6-9835.

STANDARD STEEL SPRING, DIV. OF ROCKWELL SPRING & AXLE CO. ..Page 34

GARY, IND.: (Home Office) 4040 E. Seventh Ave.

TAPECOAT CO. .....Page 48

EVANSTON, ILL.: Burton J. Schmidt, 1523 Lyons St.
ST. PAUL 14, MINN.: The Plum Co., 2295 University Ave.

TEXAS CO. .....Page 56

NEW YORK, N. Y.: (Home Office) 135 E. 42nd St.
CHICAGO 4, ILL.: 332 So. Michigan Ave.
INDIANAPOLIS 1, IND.: 3521 E. Michigan St.
MINNEAPOLIS 3, MINN.: 1730 Clifton Pl.

THERMIX CORP. .....Page 11

CHATTANOOGA 2, TENN.: Edgar A. Rogers, Chattanooga Bank Bldg.
CHICAGO 6, ILL.: Cochrane Engineering Corp., 309 West Jackson Blvd.
CINCINNATI 2, OHIO: Ellman Equipment Co., 1029 Federal Reserve Bank Bldg.
CLEVELAND 15, OHIO: The H. W. Kaiser Co., 1836 Euclid Ave.
DETROIT 12, MICH.: Metrol Co., 7145 E. Davison.
KALAMAZOO, MICH.: Metrol Co., 420 West South St.
KANSAS CITY 6, MO.: The Hesler Co., 1233 Dierks Bldg.
MILWAUKEE 3, WIS.: Cochrane Engineering Corp., 1733 West Wisconsin Ave.
MINNEAPOLIS 4, MINN.: Hoyt A. Sevey, 1525 South 5th St.
ST. LOUIS 8, MO.: Power Economy, Inc., 4526 Olive St.
TOLEDO 2, OHIO: Metrol Co., 2144 Madison Ave.

U.S. GAUGE, DIV. OF AMERICAN MACHINE & METALS, INC. .....Page 47

CHICAGO 5, ILL.: 600 S. Michigan Ave., HArrison 7-0977.
CLEVELAND 15, OHIO: Room 505, 1010 Euclid Bldg., TOwer 1-0612.
HOPKINS, MINN.: 621 E. Excelsior Ave., WEst 5-2300.

EDWIN L. WIEGAND CO. .....Page 52

CHICAGO 5, ILL.: Fred I. Tourtelot Co., 407 S. Dearborn St., HArrison 7-5507, 7-5508, 7-5509.
CINCINNATI 8, OHIO: The Smysor Company, 1046 Delta Ave., TRinity 1-0605, 1-0606.
CLEVELAND 13, OHIO: Anderson-Bolds, Inc., 2012 W. 25th St., PRospect 1-7112.
DAVENPORT, IOWA: Volco Company, 215 Kahl Bldg., 3-2144.
DES MOINES 14, IOWA: Midwest Equipment Co. of Iowa 842 Fifth Ave., DEs Moines 3-1203.
DETROIT 38, MICH.: Carman Adams, Inc., 15760 James Couzens Highway, UNiversity 3-9100.
INDIANAPOLIS 4, IND.: Couchman-Conant, Inc., Architects & Builders Bldg., MElrose 5-5313,
KANSAS CITY 6, MO.: Fraser D. Moore Co., 106 E. 14th St., VIctor 2-3306.
MILWAUKEE 3, WIS.: Gordon Hatch Co., 531 W. Wisconsin Ave., BRoadway 1-3021.
MINNEAPOLIS 4, MINN.: Volco Company, 831 South Sixth St., FEderal 6-3373.
NASHVILLE 4, TENN.: H. R. Miles and Associates, 2508 Franklin Road, CYpress 2-7016.
ST. LOUIS 1, MO.: C. B. Fall Company, 317 North 11th St., CHestnut 1-2433.

YARNALL-WARING CO. .....Page 2

CHICAGO 6, ILL.: Machinery Hall Bldg., Room 308, 549 W. Washington St., DEarborn 2-3191.
CINCINNATI 2, OHIO: 307 East Fourth St., 710 Transportation Bldg., DUnbar 1-7532.
CLEVELAND 14, OHIO: 737 National City Bank Bldg., MAin 1-6308.
DETROIT 21, MICH.: 18450 Livernois Ave., UNiversity 2-5280.
PHILADELPHIA 18, PA.: Chestnut Hill, CHestnut Hill 7-3117.
ST. LOUIS (KIRKWOOD 22) MO.: 102 W. Adams Ave., YOrktown 5-7625.

coming events

. . . for industry power

May 12-17	American Water Works Association Annual Convention	Atlantic City, N. J.
May 13-15	Purdue Industrial Waste Conference	Purdue University, Lafayette, Ind.
May 13-16	American Mining Congress	Public Auditorium, Cleveland
May 15-16	Industrial Nuclear Technology Conference	Museum of Science and Industry, Chicago
May 16-18	Engineering Industries Exposition	Statler Hotel, New York City
May 20-22	ASME Design Engineering Conference	Coliseum, New York City
May 20-22	NACE Corrosion Control Conference	Syracuse University, Syracuse, N. Y.
May 20-23	ASME Oil and Gas Power Conference	Kentucky Hotel, Louisville, Ky.
May 20-24	National Fire Protection Association Annual Meeting	Statler Hotel, Los Angeles
June 2-5	American Society of Refrigeration Engineers Annual Meeting	Hotel Fontainebleau, Miami Beach
June 2-6	Air Pollution Control Association Golden Jubilee Meeting	St. Louis, Mo.

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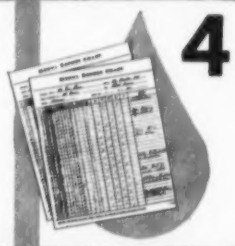

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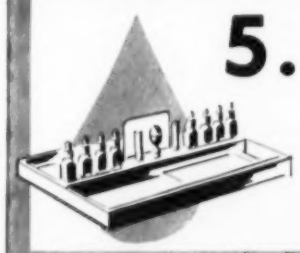

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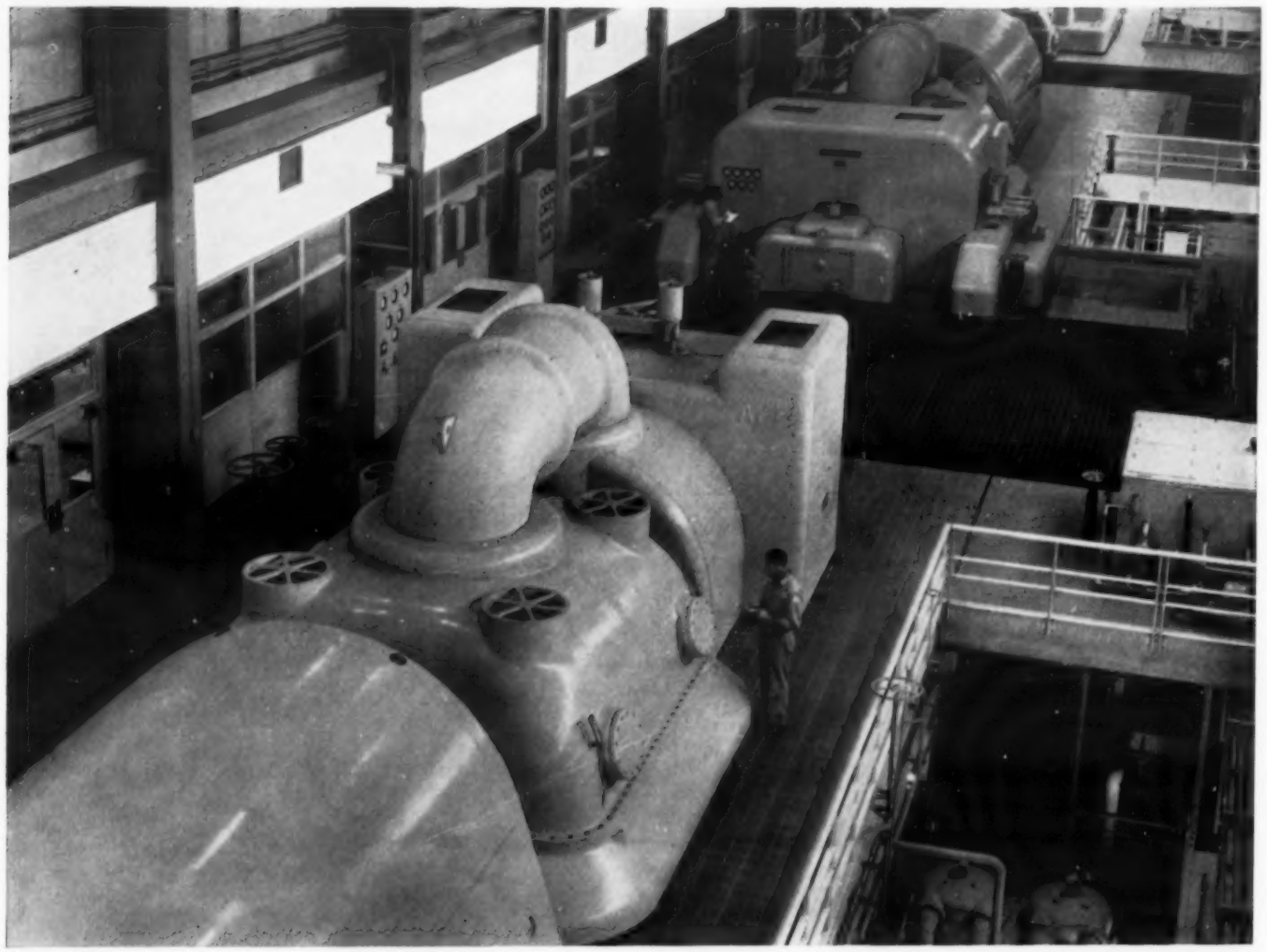

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